

THE MONIST

ST. THOMAS IN INDIA.¹

IN determining how much the religions of India owe to Christianity, our first task must be to examine the earliest possibilities of the extension of Christianity into India and to test the oldest records of this extension.

We ought first to observe that the assumption of the introduction of Christian ideas into India *by way of Alexandria* is very improbable. This has been proved conclusively by J. Kennedy.² The commercial intercourse by way of Alexandria between the Roman empire and southern India, which is abundantly attested for the first two Christian centuries by the discovery in southern India of Roman coins (from Augustus down), had ceased by the beginning of the third century. At this time commerce took its way to the farther Orient partly across the Persian Gulf and partly over the Ethiopian Adulis in the Red Sea. This was due to Caracalla's massacre in Alexandria in 215 A. D. which destroyed the significance of Alexandria in the commerce of the world. It also put an end to the colony of Indian merchants in Alexandria, of which Dio Chrysostom in Trajan's reign gives an account (*Orat.* XXXII), and with it to the direct commercial intercourse between Alexandria and India, for the Roman coins found in southern India stop abruptly with Caracalla.

¹ Translated by Lydia G. Robinson from the first chapter of Part II of the author's work, *Indien und das Christentum* (Tübingen, 1914). In the bibliographical references the following abbreviations will be observed: ERE, *Encyclopædia of Religion and Ethics*; IA, *Indian Antiquary*; JAOS, *Journal of the American Oriental Society*; JRAS, *Journal of the Royal Asiatic Society*; ZDMG, *Zeitschrift der Morgenländischen Gesellschaft*.

² JRAS, 1907, pp. 478-479, 953-955.

But might not the Indian colony in Alexandria have brought about the transmission of Christian influences to India *before* 215 A. D.? Just here lies the great improbability which we have intimated above. These Indian merchants, presumably Indians of Dravidian race, were ignorant people, according to the testimony of Dio Chrysostom (*Orat.*, XXXV). They would have taken no more interest in religious questions than did the Greek traders of their time. The absolute indifference of the author of the *Periplus of the Red Sea* towards religious matters has been mentioned elsewhere (See *Open Court*, July, 1914).

Moreover the Indians in Alexandria could hardly have heard anything of Christianity in the time of Antoninus, since the Alexandrian Christians at that time were mainly Greeks and were compelled to hold their meetings secretly because Christianity was forbidden. It would therefore have been much easier for Christians to have received information about the Buddhist religion from Indian Buddhists who chanced to live in Alexandria than the reverse, since the Indians were not compelled to keep their religion secret.

Isolated references of a later date to Indians at Alexandria prove nothing with regard to the possibility of a transmission of Christian doctrines. Such a reference is the one to the visit of the Brahman who "related incredible things" in the house of the former consul Severus in Alexandria about 500 A.D., as we learn from Damascius,³ or the acquaintance of a few Indian scholars with the astronomy and astrology of Alexandria in the fifth and sixth centuries—a knowledge, moreover, which need not in the least have come directly from Alexandria, but might equally well have been transmitted through the famous school of Edessa which later moved to Nisibis. A popular religion is not affected by the forms of a strange faith as suddenly as the conver-

³ In *Photii Bibliotheca*, ed. Bekker, II, p. 340, in J. Kennedy, *op. cit.*, p. 956.

sion of single individuals often takes place in consequence of the appealing and convincing talk of missionaries; but influences of this kind presuppose a gradual infiltration of foreign ideas during a somewhat long and close contact between two religious communities. Hence we must here take a very different standpoint from that involved in the discussion of the relation of Buddhist and Gospel narratives to each other. Strange stories travel from mouth to mouth and from people to people and finally become clothed in the garb of another religion; but dogmas and forms of worship are adopted by the followers of a different religion only in case of direct, lasting and intimate intercourse, when the ground for the adoption of such foreign elements is prepared by similarity in religious disposition or mental inclination.

Accordingly if Alexandria is not to be taken into consideration for the transmission of Christian ideas into India, the next question is, what value has the tradition that the apostle Thomas preached Christianity in India?

In the *Acta S. Thomae apostoli*, the original Syrian text of which was written in the first half of the third century, it is reported that Christ sold his slave Thomas into India to build a palace for Gondophares (Gundaphorus), the king of the Indians, who had sent to Jerusalem for a skilled architect. Thomas journeyed by water to northern India and received great sums from the king with which to do the building, but he spent all of it upon the poor for benevolent purposes. When Thomas was about to be punished with death for this by the enraged king, he was saved by the statement that he had built a palace in heaven for the king with these treasures. The king saw this palace in his dream, whereupon Thomas succeeded in converting the king and his brother Gad to Christianity. But later, after numerous miracles and conversions in the neighboring kingdom, whither he had betaken himself at the request

of the general Siforus, he was executed by lance thrusts at the command of King Mazdai (Misdeus) and buried on the scene of his martyrdom.

This place is not named in any version of the Acts of St. Thomas. Beginning with the seventh century it is called *Καλαμίνη* in Greek and *Calamina* in Latin sources. According to ecclesiastical tradition the bones of St. Thomas were later taken from this place to Edessa and in 394 were transferred from a little old church into a large basilica.

A tradition differing from this Thomas legend exists among the native Christians in southern India on the coasts of Malabar and Coromandel who regard the apostle Thomas as the founder of their church and call themselves Thomas Christians even to-day. According to their tradition St. Thomas is said to have come from the island Sokotara to Malabar in the year 52. They also shift Calamina, the place of his martyrdom and burial, to Mailapur near Madras. However the earliest evidence for this localization is found in Marco Polo at the end of the 13th century.⁴

Those who believe in such stories can only reconcile the contradiction existing between these two traditions by assuming that St. Thomas made two different missionary journeys to India.

The tradition of the Thomas Christians in southern India has not found credence in scholarly circles in recent years, except in isolated cases. Thus R. Collins has expressed his conviction that St. Thomas was the apostle of Edessa as well as of Malabar.⁵ W. Germann⁶ regards as historical the evangelization by St. Thomas of southern India and

⁴ To-day the place is called "St. Thomé" as the Portuguese named it upon their arrival in India on the basis of the legend found there among the Nestorians.

⁵ IA, IV, p. 155.

⁶ *Die Kirche der Thomaschristen*. Gütersloh, 1877.

the Indo-Iranian borderlands and also believes that the apostle died at Mailapur near Madras and that his body was removed from there to Edessa. We can understand this of a man who has the standpoint that "without the greatest miracle (the resurrection of Christ) the Christian faith would be vain" (p. 32). A. E. Medlycott, Bishop of Tricomia,⁷ shares Germann's conviction in all points without, however, being able to prove it by the mass of his material which, though scholarly, has little importance for the question of historicity. Lately a young investigator, Karl Heck, has followed in the footsteps of these men with an investigation⁸ which bears witness of scientific seriousness and comprehensive knowledge, but of course cannot prove the impossible. Heck substantiates the identification of Mailapur with Calamina by explaining that Calamina is only a "city of the kingdom of Kola" on the coast of Coromandel (pp. 34, 42). In Mazdai he recognizes Mahâdeva, a king of southern India (p. 19). These things are purely imaginary and we will see later on that a very different conclusion has been drawn from the names Calamina and Mazdai. Heck's expositions in the first part of his essay on the dispersion of the Jews in the time of Christ are interesting. In his opinion the Jewish communities in the Orient were the objective points for St. Thomas and the stages of his alleged journeys (pp. 13, 38, 40). We must acknowledge also that on page 39 Heck at least assumes the land route by way of Edessa, Nisibis and Seleucia for the apostle's missionary journey to the kingdom of Gondophares, and not the ocean route as does the narrative in the Acts of St. Thomas.

On the whole the view has long prevailed in scientific circles that not only the tradition of the Thomas Christians in southern India but also the legend in the Acts of

⁷ *India and the Apostle Thomas*. London, 1905.

⁸ Karl Heck (Professor in Radolfzell), *Hat der heilige Apostel Thomas in Indien das Evangelium gepredigt? Eine historische Untersuchung*. 1911.

St. Thomas lacks any historical foundation. But in recent decades, especially in France, England and America, there has been a reaction, since the discovery of coins and the inscription of Takht-i-Bahî have shown that a king Guduphara (= Gondophares) reigned over Parthia and the Indo-Iranian borderland in the first half of the first century after Christ, and hence that the Indian king who appears in the first part of the Acts of St. Thomas is historically attested for the place and time of the alleged apostolate of Thomas. This fact has made a strong impression, and in a number of prominent scholars has produced the conviction that a trustworthy recollection is the basis of that part of the Thomas legend in which the apostle carries on his work in Parthia and northwestern India. This conviction found further support in considerations regarding the international commercial intercourse of those times.

The first to raise the question as to whether contemporary relations actually existed between the apostle Thomas and the king Gondophares who has been proved historical by the discovery of coins, was Reinaud, in the year 1849. But the first to express himself in this sense with any attempt at a scientific basis is the eminent French Indianist Sylvain Lévi;⁹ nevertheless in the last sentence of his article (p. 42) the journey of the apostle Thomas to India is characterized in an apposition as *réel ou imaginaire*. Those who have declared themselves to be completely, or almost completely, convinced of the historical character of this journey are E. Washburn Hopkins,¹⁰ W. R. Phillips,¹¹ J. F. Fleet,¹² W. W. Hunter,¹³ Vincent A. Smith,¹⁴ G. Grierson,¹⁵ and of German investigators mainly

⁹ *Journal Asiatique*, 1897, I, pp. 27f.

¹⁰ *India Old and New*, p. 141.

¹¹ *IA*, XXXII, pp. 1f, 145f.

¹² *JRAS*, 1905, pp. 223f.

¹³ *The Indian Empire*, 3d ed., p. 286.

¹⁴ *The Early History of India*, 2d ed., pp. 218-221.

¹⁵ *JRAS*, 1907, p. 312; similarly *ERE*, II, p. 548b.

the Jesuit Joseph Dahlmann, with whose book on the subject¹⁶ we must occupy ourselves more closely.

The English and American scholars just mentioned have not perceived that they have become victims of a fallacy. From the fact that the king of the Thomas legend is historical they have forthwith drawn the conclusion that the apostolate of Thomas in the domain of this king is also historical, and have overlooked the fact that some well-known personage from history, and particularly a king, happens to appear with extraordinary frequency in legends behind which no one would suspect an historical event. This observation does not apply to Dahlmann, for he has kept before him the possibility "that into the fabric of a legend some actually historical features may be woven, and yet if this were proved little would be gained for the question of the authenticity or unauthenticity of the legendary tradition. For particular geographical and historical features may be woven into the legend—the names of historical personages, circumstances whose reality is beyond question, citations of locality which correspond to the truth—and yet the tradition as such may lack intrinsic authenticity."¹⁷ But I can not find that Dahlmann has allowed himself to be guided in his investigation by the critical spirit which speaks in these words.

Further, Dahlmann says on page 6: "In a dark and suspicious corner of early Christian literature where we push step by step up the luxuriant lattice of free discovery we see we are lost when we take the Apocrypha for guide. Poetic fancy there carries on so capricious a play that it seems impossible to draw the line between truth and invention, historical tradition and arbitrary adornment. The

¹⁶ *Die Thomas-Legende und die ältesten historischen Beziehungen des Christentums zum fernen Osten im Lichte der indischen Altertumskunde* (Number 107, a sequel to the *Stimmen aus Maria-Laach*. Freiburg i. Br., 1912).

¹⁷ *Op. cit.*, pp. 12-13.

story of the apostle's journey to India is no exception to this rule." These remarks are perfectly correct; but instead of applying them practically Dahlmann utilizes the Acts of St. Thomas as a *historical source* of the greatest significance, although it "betrays not the slightest knowledge of Indian relations, customs and usages or even of Indian geography."¹⁸

By drawing upon what we know with regard to the ocean traffic and commercial relations of the first century A. D. and with regard to the art of the Gandhâra country (i. e., the Kabul valley and surrounding territory) and all other material which bears upon the question, Dahlmann with his usual eloquence has tried to prove what it is his heart's desire to believe, but what nevertheless can not be proved. He finds himself here, as in several previous works, in the deplorable position of fighting with great scholarship, energy and enthusiasm for an untenable position. What an eminent Catholic Indianist once said about an older work of Dahlmann is true also in this case:¹⁹ "Unintentional self-deception indeed seems in our author to go hand in hand with an unmistakable purpose and to play him an evil trick."

The historicity of the kernel of the Thomas legend lies particularly close to Dahlmann's heart for the following reason. Some years previously²⁰ he tried to prove that the Mahâyâna school of Buddhism which arose in the extreme northwestern part of India at the beginning of our era owes its most valuable ideas to Christian influences and that it is only as a result of this enrichment that northern Buddhism has attained its enormous expansion. But this thesis is absolutely untenable.

When we see what Dahlmann's purpose is we can understand how much it meant to him to furnish a proof

¹⁸ Winternitz in *Deutsche Lit. Ztg.*, 1913, col. 1755.

¹⁹ Edmund Hardy in *Lit. Zentralbl.*, 1898, col. 1194.

²⁰ In his *Indische Fahrten*, Freiburg i. Br., 1908, 2 vols. Chapters 25-27.

that Christianity had penetrated into the Indian borderland by the middle of the first century. For this it was positively necessary that the apostolate of Thomas in that locality be historical. To the reasons which his predecessors had brought forward for this, Dahlmann added a new one in his *Indische Fahrten*, namely the combination of apostleship and artistic handiwork in the person of Thomas. Dahlmann believed that he could explain the alleged Christian influence in the art of Gandhâra by the activity of the apostle Thomas in the Indian borderlands. In his new work Dahlmann takes a somewhat different standpoint. He grants²¹ that the general similarities which exist between early Christian art and the art of Gandhâra can be explained by the fact that the artists of both groups have drawn from one and the same source, namely from the classical art of the Roman empire; and further he says (p. 100): "That the Buddha-type of Gandhâra should have arisen in connection with the Christ-type, as Fergusson and Smith are inclined to assume, is not merely improbable but absolutely impossible." But he lays the greatest weight upon the fact, "that the Parthian-Indian field of labor ascribed to the apostle in the legend is connected by special commercial and artistic relations with the Roman province (Syria) from which Christianity proceeded" (p. 108).

I would like to answer the argument for the legendary artistic occupation of the apostle by the pertinent observation of O. Wecker,²² that in the legend of St. Thomas the Christian apostle is not brought into relation with the kind of artistic activity which most clearly betrays connection between Gandhâra and the west, that is to say with sculpture, but with the work of an architect and carpenter

²¹ *Thomas-Legende*, pp. 96f.

²² *Tübinger Theol. Quartal-Schrift*, XCII, p. 561. Wecker refutes Dahlmann's demonstration in a happy manner but does not come out against belief in the historical character of the Thomas legend with as great decision as might be desired. For him the possibility still exists that Thomas may really have been in India. *Ibid.*, pp. 559-560.

which may probably be accounted for by the imagery of the construction of church or temple current in Christian modes of speech.

On the other hand Winternitz, who in other particulars takes throughout the standpoint which I represent, asserts²³ that in the Syrian text of the Acts of St. Thomas the apostle says to the merchant Habbân who brings him from Jerusalem: "In wood I have learned to make plows and yokes and ox-goads and rudders for boats and masts for ships; and in stone, gravestones and monuments and palaces for kings." Winternitz thinks that we can regard the gravestones and monuments as well as the decorations of the palaces as referring certainly to the Gandhâra sculptures. I would like to contradict this; for according to the legend Thomas is brought merely for the purpose of building a palace for King Gondophares, and in the Greek version of the Acts of St. Thomas in the corresponding passage he only declares that he understands how to make "(tomb-) pillars and temples and royal palaces out of stone." Probably this is the way the Syrian text also is to be understood. But what Winternitz goes on to say is very true: "Though the dependence of the Gandhâra art upon the west is certainly historical, yet it is not exactly probable that Grecian artists would have been sought in the streets of Jerusalem."

Moreover, it should be pointed out that according to the legend the apostle Thomas did not build at all in the realm of Gondophares and that he is said to have come to this kingdom not by the land route through Syria but by the ocean. Accordingly in Dahlmann's sense the artistic activity of the apostle and the artistic relations between the Parthian-Indian realm and Syria have nothing to do with the case in hand, and it is a simple fallacy when he says on pages 109-110: "The historical elements which

²³ *Deutsche Lit. Ztg.*, 1913, col. 1752.

are woven into the legend may be referred to two fundamental data: to the association of the apostle's name with the name of a Parthian-Indian king and to the latter's relations with western art. From this double connection the conclusion may be drawn that the kernel of the tradition, i. e., the knowledge of a missionary journey which brought the apostle Thomas into contact with a Parthian-Indian kingdom, can not be invented but must rest upon a *historical foundation*."

The way in which Dahlmann makes the second part of the legend of St. Thomas, dealing with the martyrdom and burial of the apostle in the realm of King Mazdai, serve his purpose is characteristic. He adopts Sylvain Lévi's very doubtful identification of King Mazdai with the Indo-Scythian king Vâsudeva (epigraphically BAZOΔEO) in which Sylvain Lévi thinks he has found a contemporary of Gondophares. But Vâsudeva lived considerably later than Gondophares, in all probability not until the end of the second or beginning of the third century, so that Dahlmann is obliged to explain the apostle's martyrdom in the realm of King Mazdai as an invention of poetic fancy. Nevertheless Dahlmann finds a historical kernel even in this part of the Thomas legend. To him Mazdai is an actual king who governed the realm, which is said to have formed the field of the apostle's activity, at the time when the latter's relics were alleged to have been brought from India to Syria. "The anachronism which transforms a prince who lived one hundred and fifty years later into a contemporary of the apostle was caused by the report that the relics came from the realm of King Mazdai" (p. 147). A very arbitrary assumption! That Dahlmann believes also in the tradition of the transference of the bones of St. Thomas to Edessa was to be expected from the whole drift of his expositions.

The other names of the second part of the Acts of St.

Thomas Dahlmann knows also how to interpret historically and geographically. General Siforus is the Parthian satrap Sitapharna; the place of martyrdom Calamina is Kalyâna in the vicinity of Bombay; the mountain Gazus where St. Thomas met his death after his passion denotes the Ghats mountains (pp. 153, 156-157). Dahlmann is a master at imaginary combinations. Even in the tradition of the Thomas Christians in southern India, which he regards as unauthentic, he finds valuable evidence for the historical character of the traditions of northern India, as is shown in the last chapter of his book.

In reality the whole Thomas legend is as much invented as, in Dahlmann's opinion, is the apostle's martyrdom in the kingdom of Mazdai. This became clear in 1864 by the critique to which Alfred von Gutschmid subjected the Thomas legend in his famous essay, "Die Königsnamen in den apokryphen Apostelgeschichten."²⁴ Gutschmid justly emphasizes the great intrinsic improbability that Christianity should have spread so early into so remote a region before it had obtained a firm footing anywhere in western Iran; for the natural way from Syria to India would have been by land. Gutschmid furnishes a further proof, which for the most part still holds to-day, that the first part of the Thoms legend is a transformation of a *Buddhist* missionary tale.²⁵ White India or Arachosia (hence the special kingdom of Gondophares) was converted to Buddhism in exactly the period in which the Thomas legend is set. Accordingly we have here a very similar case to that of the legend of St. Bartholomew which was originally a story of Jewish conversion with the scene laid in Armenia or Media but later was given a Christian setting and significance and transferred to India.²⁶ Ernst Kuhn in a personal letter plausibly identifies the Indian king Polymius in

²⁴ *Kleine Schriften*, edited by Franz Rühl, II, pp. 332f.

²⁵ Rejected by Winternitz, *Deutsche Lit. Ztg.*, 1913, col. 1754.

²⁶ Wecker, *Tüb. Theol. Quart.-Schr.*, XCII, p. 556.

the *Passio Bartholomaei* with Pulumâyî. I assume that of the three Andhra kings of this name, Pulumâyî I (26-58) and not Pulumâyî II (138-170) or Pulumâyî III (229-236) is meant.²⁷ We would then have in the legend of Bartholomew exactly the same case as in the Thomas legend, namely that a known Indian king from the middle of the first century has been interwoven into the apocryphal story of the apostle.

Ernst Kuhn has likewise most kindly called my attention to the fact that the palace which Thomas claimed he had erected in heaven for King Gondophares corresponds to the Buddhist Vimânas from which the Vimânavatthu received its name. This work is a description of the celestial abodes and their delights with a list of the good works for which the inhabitants of these heavenly worlds will be rewarded by the enjoyment of such bliss.²⁸

The recasting of the Buddhist original into the Thomas legend hardly took place before the beginning of the third century. Gutschmid has expressed the very probable view that the Christians became acquainted with the supposed story of Buddhist conversion through the Syrian Gnostic Bardesanes who was well informed on Buddhist and Indian conditions in general.

At any rate there were no Christians within Indian boundaries before the third century. The wider extension of Christianity in general, of course, began in the middle of the second. The earliest account of the presence of

²⁷ The periods of these reigns are given according to the approximate calculation of Vincent A. Smith, *The Early History of India*, 2d ed., in the chronological table following page 202.

²⁸ This combination is opposed by Winternitz (*op. cit.*, col. 1754) on what in my opinion is an insufficient ground. Perhaps Winternitz will abandon his opposition when he learns of Kuhn's further observation that the description of the visit to hell of Gad, the brother of Gondophares,—at least in the Syrian poem of Jacob of Sarug—exactly resembles the story of Revati in the Vimânavatthu (Chap. 52). Cf. S. R. Schröter, "Gedicht des Jacob von Sarug über den Palast, den der Apostel Thomas in Indien baute," ZDMG, XXV, pp. 360f; and L. Scherman, *Materialien zur Geschichte der indischen Visions-litteratur*, pp. 56f.

Christians in Parthia and northwestern India in Origen—hence in the first half of the third century—is an indirect one.²⁹ The statement of Bardesanes, who speaks of the existence of Christian communities in Parthia, Media, Persia and among the Bactrians and Geles, would lead us³⁰ to a somewhat earlier period, that is to say, to the *beginning* of the third century. But now since later research has shown that the Syrian original "On Fate" in which this statement originates was not written by Bardesanes himself but by one of his disciples, the note is probably later than that of Origen. If this disciple of Bardesanes had known of any Christians within Indian boundaries he certainly would not have kept silent about them in his enumeration. It therefore still remains doubtful whether the first entrance of Christianity into the land of the Indus took place as early as the first half of the third century.

Historically we know absolutely nothing about St. Thomas except that he was one of the twelve apostles, and these Wellhausen regards as a council instituted after the death of Jesus. I may here introduce a few sentences containing information that seems to me serviceable from a letter that Th. Nöldeke wrote me on this question January 6, 1910: "The introduction of Thomas in the Gospel of John is as arbitrary as a number of similar references to persons and places in the Fourth Gospel. The statement that the body of Thomas was removed to Edessa (the earlier sources leave out the 'from India') is probably only an adjustment of two traditions, one saying that he was buried in Edessa where his tomb is shown, and the other in the legend [of his burial in India]. Neither of course is historical."

All investigators who are inclined to regard as histor-

²⁹ Harnack, *Mission und Ausbreitung des Christentums in den ersten drei Jahrhunderten*, 2d ed., II, p. 126.

³⁰ In Eusebius, *Praep. Evangel.*, VI, 10.

ical³¹ the basis of the Thomas legend, i. e., his apostolate in Indo-Iranian countries, are in my judgment driven to it by an apologetic impulse though perhaps unconsciously. They do not, however, observe at the same time how greatly they would increase the "Buddhist peril" for the New Testament if they were right. For if there had been Christians in one of the many Buddhist countries as early as the middle of the first century, hence before the Gospels were written, then the natural connection of these Christians with Syria and Palestine would cause the contested transmission of Buddhist elements into the Gospel—especially into the two that bear the names of Luke and John—to appear in a much clearer light than is the case without the historical basis of the Thomas legend.

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The absolute unreliability of the Thomas legend must be established before we can proceed in a scientific manner to the questions as to how early the so-called Thomas Christians had settled along the coast of southern India and where they had come from. Unfortunately the preliminary question as to how the name "Thomas Christians" originated can not be answered with certainty. Various possibilities present themselves by way of explanation. Travelers of the early Middle Ages may have called the Christians whom they found in southern India "Christians of St. Thomas" on the basis of the familiar Thomas legend, and the native Christians may have adopted and retained this designation—this is Burnell's view.³² Or else the

³¹ G. Faber has recently joined their ranks and in his work *Buddhistische und neutestamentliche Erzählungen*, p. 24, declares that the authenticity of the apocryphal Acts of St. Thomas "according to the recently published extremely keen and comprehensive treatment of Joseph Dahlmann can in his opinion no longer be questioned." This sentence and his further expositions on the subject (p. 26-27) Faber would probably not have written if he had read my review of Dahlmann's book in the *Ostasiatische Zeitschrift*, I, pp. 360f, or Winternitz's later criticism in the *Deutsche Lit. Ztg.*, 1913, col. 1750f. At any rate Faber will not find any of the German Indianists to agree with him.

³² IA, III, p. 309.

name may have originated, according to a probability frequently expressed, by a confusion of St. Thomas with Thomas of Cana (also called Thomas Kama or some similar form, and Mar Thomas) under whose leadership a large number of Christians, alleged to be from Bagdad, Nineveh and Jerusalem, immigrated to Malabar in the year 745 and strengthened the Christian communities already there upon whom this reinforcement must have made a strong impression. This Thomas founded for the new Christian immigrants the city of Mahâdevapattana in the neighborhood of Cranganore, erected many churches in that locality, established seminaries for the education of the clergy and acquired important privileges for the Thomas Christians from the rulers of the country.³³

There are still other possibilities of confusion, for in those days there was a large number of prominent men by the name of Thomas.³⁴

W. W. Hunter³⁵ represents a view which differs from both of the possibilities mentioned. He proceeds from the idea that the Persian church had appropriated the name of "Thomas Christians" in the seventh century and that in time this designation spread to all branches of that church, hence also to Malabar; that the old legend of the

³³ G. M. Rae, *The Syrian Church in India*, pp. 162-163; Lassen, *Indische Altertumskunde*, 2d. ed., II, p. 1121; Karl Heck, *Hat der heilige Apostel Thomas in Indien das Evangelium gepredigt?* pp. 21-22. The accounts of this "Thomas Cananaeus" are very contradictory; his home is assigned both to Jerusalem and to Armenia. At any rate he was an influential and very well-to-do merchant who was bishop of the Christians of southern India at the time of his death. K. Kessler in Herzog's *Realencyklopädie*, 3d ed., XIII, p. 735, placed him in the beginning of the ninth century; Germann (*Die Kirche der Thomaschristen*, p. 92), and others (see V. A. Smith, *The Early History of India*, 2d ed., p. 222, note 1), even as early as the year 345. The coincidence in the two last figures of the dates 745 and 345 makes it probable that in the date 345 we may have an old error of the pen or print for 745, which has been handed on. Ad. Lipsius, *Die apokryphen Apostelgeschichten*, I, 1883, pp. 283f., has accepted Germann's statements about the confused traditions with regard to this man without taking exception to the double number 345/745. Lassen (*op. cit.*) suggests the year 435. Here again we have the three figures of the year 345 in another arrangement.

³⁴ Germann, pp. 99-201.

³⁵ *The Indian Empire*, 3d ed., p. 287.

Manichæan Thomas of the third century, and the later activity of the above-mentioned Thomas of Cana, the reviver of the church of Malabar, had by the eighth century increased the respect for that name among the Christians of southern India. Thus far his assumptions seem to consist of conjectures without foundation. But afterwards his expositions amount to the old and very probable confusion theory when he adds the remark that perhaps in their comparative isolation and ignorance the Christians of southern India had mixed up the three names and had concentrated the legends of the three Thomases upon the person of the apostle, and that before the expiration of the fourteenth century this process had ended in the conviction of those Christians that their St. Thomas and Christ were one and the same person. The last remark of Hunter arises from an erroneous conception; for Thomas, the "twin brother of the Lord," has elsewhere also often been confused with Christ, especially by the Syrian Christians. Hence the identification is not the work of the isolated Thomas Christians in Malabar, but originates in the home of Nestorianism.

How long the Thomas Christians have been in southern India is not easy to determine. In his treatment of the subject—unfortunately very short—Harnack³⁶ is right in saying: "That the 'Thomas Christians' who were again discovered in India in the sixteenth century³⁷ extend back

³⁶ *Mission und Ausbreitung des Christentums*, 2d ed., II, pp. 126-127. H. Achelis, *Das Christentum in den ersten drei Jahrhunderten* (2 vols., Leipzig, 1912) does not touch at all upon the question of the extension of Christianity into India.

³⁷ Harnack has overlooked the fact that Marco Polo had already rediscovered them at the end of the thirteenth century, and that several other witnesses from the fourteenth and fifteenth centuries follow him. A. Burnell says (IA, III, p. 311, note): "The most important historical notices of Nestorians and Syrians in India which I can find are: (1) by Friar Odoricus, who about the beginning of the fourteenth century was in southern India and mentions fifteen houses of Nestorians at St. Thomas's shrine; (2) by Nicolo Conti who traveled in India in the fifteenth century. Speaking of Malepur (St. Thomé) he says: 'Here the body of St. Thomas lies honorably buried in a very large and beautiful church; it is worshiped by heretics who are called Nestorians and inhabit this city to the number of a thousand. These Nestorians are

to the third century can not be proved." In France, England and America, there is a different opinion. In these countries scholars seem inspired with the desire to prove the authenticity of apocryphal legends, and to attribute a greater antiquity to the expansion of Christianity than strict historical critique can concede. We may here recall the judgment of those scholars on the Thomas legend. Hopkins³⁸ states without any qualification, "that Pantaenus was expressly sent to teach the Brahmans in India, and found a Christian church already established there in 190 A. D." This belief is shared by W. W. Hunter³⁹ and J. Kennedy⁴⁰ whereas in Germany it is the universal and well-justified assumption that southern Arabia is to be understood by the India to which Pantaenus (according to Eusebius, *Hist. eccl.*, V, 10) went as missionary from Alexandria.⁴¹ All of southern Asia was called India in those days; and when Eusebius reports that Pantaenus had already found a Christian community in India possessing the Gospel of Matthew in the Hebrew language, we can, in fact, only think of a less remote country, that is, of southern Arabia, where the Jews were living in great numbers at the time.

Directly before the above mentioned note on Pantaenus Hopkins says without mentioning his source: "We know also that a great colony of Jews emigrated from Palestine—ten thousand in all—and settled on the Malabar coast in A. D. 68." Now this remark is by no means consistent with the essay, "Christ in India"; for the Jews would certainly not have made the extension of Christianity scattered over all India.' (*India in the Fifteenth Century* published by the Hakluyt Society, p. 7.)" The traveler Giovanni de' Marignolli in the fourteenth century also told about the place and the Thomas legend that clung to it. Colonel Yule, *Cathay and the Way Thither* (Hakluyt Society, 1866), II, p. 375; Rae, *The Syrian Church in India*, pp. 124-125; *Encyclopædia Britannica*, s. v. "Marignolli."

³⁸ *India Old and New* in the essay "Christ in India," p. 141.

³⁹ *The Indian Empire*, 3d ed., p. 285.

⁴⁰ *JRAS*, 1907, pp. 479, 955-956.

⁴¹ Harnack, *op. cit.*, p. 126; G. Krüger in Herzog's *Realencyklopädie*, 3d ed., XIV, p. 627, s. v. "Pantaenus"; *Die Religion in Geschichte und Gegen-*

ity into India any business of theirs. But the incredibility of the statement in itself is obvious and is increased by the consideration that even in our own time, according to the census of 1911, there are only 18,000 Jews in all India. My inquiries for the source of the fantastic information of Hopkins have been without success. I have only found the following note by W. W. Hunter:⁴² "Whether these Jews emigrated to India at the time of the dispersion, or at a later period, local tradition assigns to their settlements an origin anterior to the second century of our era." Th. Nöldeke wrote me January 20, 1910, on the subject as follows: "Whence Hopkins gets his information about the 10,000 Jewish emigrants to India in 68 A. D. I can not imagine. At any rate it is nonsense (so he says 'we know!'). Your assumption that southern Arabia, [or rather, Abyssinia (*Αἰθιοπία* in the broader sense)] is here called India is certainly correct, but even then the account is unhistorical. Of course the Jews have carried on propaganda in both places, especially in Abyssinia, with great success; but we have no *historical* account of the origin of these undertakings nor even about Jews, or Arabs converted to Judaism, in northern Arabia."

In fact the oldest evidence for the existence of Christian communities on the western coast of southern India is found in the account of Kosmas Indikopleustes, which is based upon observations during the years 525-530. Kosmas, an Egyptian merchant who in his younger years had made several business journeys to India and had later become a monk, is the author of a startling work on "Christian Topography," in which with great garrulity he opposes scientific geography and especially the great geog-

zwart, edited by Schiele and Zscharneck, III, p. 468. Rae, *The Syrian Church in India*, pp. 67f, regards the India of Alexander the Great, i. e., the valley of the Indus, as the scene of the operations of Pantaenus. Edmunds agrees with him, *Buddhist and Christian Gospels*, 4th ed., I, pp. 145-146.

⁴² *The Indian Empire*, 3d ed., p. 284.

rapher Ptolemy. Kosmas denies that the earth is round and declares that it is an elongated disk surrounded by high walls upon which the firmament rests like a roof. The change from day to night is caused by the sun revolving around a monstrous mountain in the extreme north. This monkish folly to be sure does not arouse any predisposition in favor of Kosmas's account of his journeys, and his trustworthiness is not exactly increased by the fact that he saw the tracks in the Red Sea made by the wheels of Pharaoh's chariot when pursuing the children of Israel. But the way in which Kosmas in the midst of his stupid description of the earth tells what he had seen previously as a merchant in India, gives the impression of actual observation. W. Vincent⁴³ finds no echo to his statement that Kosmas was never in India. It is disproved by reference to the correct Indian names and words which Kosmas introduces (*καστοῦρι*, "Moshustier" in Book XI is, by the way, the earliest record of the Sanskrit *kastûri*). Evidently the west coasts of India and Ceylon were well known to Kosmas. From what he tells us about these localities the following is of interest to us:⁴⁴ "On the island Taprobane (Ceylon) . . . there is also a Christian church and clergy and believers, . . . likewise also in *Μαλέ* (= Skt. *Malaya*, 'Malabar') where pepper grows; and in the city which they call *Καλλιάνα* there is also a bishop who is appointed in Persia." And in the section "On the island Taprobane" in Book XI Kosmas completes the above account with the words:⁴⁵ "This island also possesses a church for the Persian Christians living there, and a presbyter appointed in Persia and a deacon, and the whole ecclesiastical service; but the natives and the king belong to another people and have many shrines on this island." With the

⁴³ *The Voyage of Nearchus* (1797) in the French Version of Billecoq, pp. 363n, 544n.

⁴⁴ Kosmas, ed. Winstedt, III, p. 119.

⁴⁵ Page 322.

last words Kosmas indicates that the natives in Ceylon profess another religion, namely, Buddhism.

By "Male where pepper grows," we are without any doubt, according to Burnell, to understand the seaport Travancore. As far as the city Kalliana (Sanskrit *Kalyâna*) is concerned, we may hesitate between two ports of this name on the western coast. One of these, thirty-three miles northeast of Bombay, the Kalyân of to-day on the Ulhas river, is known as an ancient provincial capital; the other lies about thirty-two miles north of Mangalore. This second place, which to-day is an unimportant village, Burnell regards as the city referred to by Kosmas; for, as he says, Kosmas names as the chief articles of export from Kalliana *χαλκός* (by which only steel could be understood) and cotton cloth; and that steel seems to have been produced only in the southern part of the Dekkan, in Maisur and Salem.⁴⁶ This argument is easily refuted, for *χαλκός* does not mean steel or hardened iron. It means of course what it has always meant except when it has denoted bronze, namely copper, for which the Greek language has no other term. All probability then is in favor of the idea that the account of Kosmas refers to the famous old city, Kalyâna (or Kalyâni), in the vicinity of Bombay.

Kosmas's particulars about the bishop of Kalliana ordained in Persia and about the exclusively Persian Christian community in Ceylon leave no doubt as to the descent of the Christian in Southern India and the error of their own tradition. When Burnell says: "All the trustworthy facts up to the tenth century. . . go to show that the earliest Christian settlements in India were Persian,"⁴⁷ he is certainly as much in the right as he is mistaken in his assumption that the earliest colonists in southern India were Manichæan immigrants. This latter assumption, and

⁴⁶ Burnell, *IA*, III, p. 310.

⁴⁷ *Op. cit.*, p. 311. Cf. also J. Kennedy, *JRAS*, 1907, p. 956; O. Wecker, *Tüb. Theol. Quart. Schr.*, XCII, 1910, p. 541.

the basis upon which it rests, was rejected by Collins⁴⁸ and since then has not found any supporters.

The Persian descent of the Christians in southern India is likewise attested by the Pahlavi inscriptions found in that locality which have been discussed by Burnell in the essay already frequently cited.⁴⁹ The earliest of these inscriptions do not date back farther than the seventh or eighth century.⁵⁰

When we inquire into the occasion that brought the earliest colonies of Persian Christians to southern India, next to the commercial interests the Persian persecutions of the Christians in the years 343 and 414 suggest themselves. Fugitives might have been driven by these persecutions to India, just as at a later time the Pârsis who were oppressed by Islam found a new home in this tolerant land which first learned religious intolerance from its Mohammedan conquerors. Since there was no authentic witness for the presence of Christians along the southwestern coast of India *before* Kosmas, as we have seen, we may assume that the first Christian colonies in Malabar were founded by persecuted Persian Christians in the middle of the fourth century.

J. Kennedy has repeatedly asserted⁵¹ that even at this time there was a monastery of Persian monks in the interior of Ceylon. Now no one who is acquainted with the fact that the earliest conventual communities were established then for the first time in Egypt and Syria, the very cradle of Christian monasticism, will consider it possible that at that early date the Christian custom of founding monasteries could have penetrated as far as remote Ceylon. At first I thought that Kennedy had confused a Buddhist

⁴⁸ IA, IV, pp. 153f.

⁴⁹ IA, III, pp. 311f.

⁵⁰ Hardly to the fifth. Cf. the bibliography in Wecker, *op. cit.*

⁵¹ JRAS, 1907, pp. 480, 957, note 3, following Labourt, *Le Christianisme dans l'Empire Perse*, p. 306. (In Kennedy the reference is wrongly given as p. 606.)

with a Christian monastery, but then I considered it necessary nevertheless to investigate his source and found to my surprise that it consisted merely of this legendary note in Labourt: "S'il faut en croire l'hagiographe Zâdoë, prêtre et solitaire, chef du monastère de Saint-Thomas dans le pays de l'Inde, dont le siège est fixé sous les pays de Qatrayê, à Ceylan, l'île noire. . . ." Qatrayê, as my colleague Seybold informs me, is one name for eastern Arabia.

As a proof of the early entrance of Christianity into India Grierson cites⁵² that "Chrysostom (fourth century) tells us of Christian treatises translated into Indian languages." Here he doubtless means the often quoted passage in Johannes Chrysostomus, *Hom. on John ii. 2*:⁵³

ἀλλὰ καὶ Σύροι καὶ Αἰγύπτιοι καὶ Ἰνδοὶ καὶ Πέρσαι καὶ Αἰθίοπες καὶ μύρια ἕτερα ἔθνη εἰς τὴν αὐτῶν μεταβαλόντες γλῶτταν τὰ παρὰ τούτου δόγματα εἰσαχθέντα ἔμαθον ἀνθρώποι βάρβαροι φιλοσοφεῖν.

But this witness, especially in consideration of the ambiguity between Ἰνδός and Ἰνδία existing at that time, is absolutely worthless. Even the added phrase καὶ μύδια ἕτερα ἔθνη shows what we must think of the conglomeration of national names in this pathetic homiletic passage. Since there is no other trace of a translation of the New Testament or of any other Christian document into Indian languages from so early a time nor even from any of the following centuries up to the beginning of modern times, we must not see a historical witness in the words of Chrysostom, but merely a thoughtless rhetorical expression.⁵⁴

The date when the Christians in southern India became subordinate to the Nestorians, can be determined with practical certainty. Burnell's view⁵⁵ that this did not occur

⁵² JRAS, 1907, p. 498. Edmunds, in *Buddhist and Christian Gospels*, 4th ed., I, p. 146, also regards this evidence as authentic.

⁵³ Migne edition, *Patrol.*, LIX, 32.

⁵⁴ Tiele, *Theologisch Tijdschrift*, 1877, p. 71, in Carl Clemen, *Religionsgeschichtliche Erklärung des Neuen Testaments*, p. 28, note.

⁵⁵ IA, III, p. 311.

before the eleventh or twelfth century because we find first mention of Syrians living in India in travelers' reports in the Middle Ages requires no refutation. Nor is W. Koch's⁵⁶ statement correct, that the Nestorians became connected with the Thomas Christians in India proper in the seventh century, because we have evidence of a connection between the Thomas Christians in southern India and Persian Nestorianism as early as the beginning of the sixth century. Kosmas's statement that the bishop of Kalliana and the presbyter at Ceylon had been appointed from Persia shows the dependence of the parishes there on the Nestorian patriarchate. In the beginning of the sixth century the only ecclesiastical head in Persia was the Nestorian catholicos of Seleucia-Ctesiphon, because in the second half of the fifth century King Pêrôz (Pheroses) declared in an edict that Nestorianism was to be the only permitted form of Christianity in his kingdom, which led to the cruel extermination of the Persian Christians adhering to the orthodox church,⁵⁷ and because in the year 498 the bishop of Seleucia formally renounced his allegiance to Antioch and by so doing founded the dissenting church of Persian Nestorians.

When M. Haug⁵⁸ tried to place the date of the Nestorian church in India back in the fifth century, he was certainly under the influence of Catholic tradition, according to which Nestorianism spread about 486 to Malabar from Babylon, i. e., probably from the district between the Euphrates and Tigris.⁵⁹ The authenticity of this tradition is contradicted by the intrinsic improbability that Nestorian influence could have expanded in a foreign country at a time of severe internal conflict. We may assume that this did not take place until the beginning of the sixth century,

⁵⁶ In the article "Nestorianismus" in Michael Buchberger's *Kirchliches Handlexikon*, II, p. 1104.

⁵⁷ Rae, *The Syrian Church in India*, p. 107.

⁵⁸ In Germann, *Die Kirche der Thomaschristen*, p. 301.

⁵⁹ Hunter, *The Indian Empire*, 3d ed., p. 279.

after the consolidation of the Persian dissenting church. This is also the opinion of Rae⁶⁰ who, to be sure, bases it only on the Persians' growing fondness for ocean travel and for the increase of commerce.

The Christian parishes on the west coast of India at that time combined with those scattered through Arabia to form a diocese under the control of the metropolitan of Persia. We must not, however, overestimate the spread of Christianity on the coast of western India in those days. When Kessler⁶¹ says that the entire western coast of India must still have been Christian at the beginning of the seventh century this is merely a conjecture. The words "must have been" alone prove the weakness of the position. Nor is there evidence to show that in the preceding sixth century the entire west coast of India had been Christian.

Further expositions of Kessler in the same place teach that the union of the Christian parishes in India with the Nestorian patriarchate had become greatly relaxed by the middle of the seventh century and after a temporary strengthening broke off entirely in the ninth century. I here quote the most important sentences: "Shortly after Kosmas, about 570, the presbyter Bôdh had to inspect the churches of India as *periodeutes*; . . . but Jesujahb of Adiabene (*Patr.* 659-660) complains in his writings that through the fault of Simeon, the metropolitan of Persia, and that of his predecessor the churches of India had become quite orphaned. . . . The 'Thomas Christians' in India were assigned a metropolitan for the first time under the patriarch Timotheus (778-820). . . . This union with the Nestorian patriarchate seems to have been discontinued soon afterwards."⁶²

⁶⁰ *The Syrian Church in India*, pp. 116, 118.

⁶¹ In the article "Nestorianer" in Herzog's *Realencyklopädie*, 3d ed, XIII, p. 728.

⁶² *Ibid.*, pp. 728, 735.

The time when the Thomas Christians made themselves ecclesiastically independent coincides with their political independence, for in the eighth and ninth centuries the Christians in Malabar obtained from the native princes the right of self-government and such important privileges that for the time being they formed an independent state with kings of their own.⁶³ In their seclusion the Thomas Christians did not in the least preserve their religion uncorrupted, and in the fourteenth century they even abandoned baptism. However, up to the time of their persecution by the Jesuits they occupied a very respected position in southern India on account of their high moral tone.⁶⁴

To-day the small communities of Thomas Christians in southern India, together with the Nestorian parishes in the Kurd mountains and on the Lake of Urmia comprise the scanty remnant that is left of the Nestorian church which once was so strong in central and upper Asia.⁶⁵

The result of my discussions for our subsequent inquiry I can summarize thus: The small Christian communities in southern India known by the name of Thomas Christians consisted first (in the fourth and beginning of the fifth centuries) of Persian immigrants; these were joined later by Jews and native Indian members of the Dravidian race.

Christian influence upon Indian religions could not have been felt from these communities before the Neo-Brahmanism of the twelfth century; for previous to that the centers of religious life lay in *northern* India. Therefore for this earlier time we can only consider the Christians in the *northwestern borderland* as possible mediums of Christian thought. There, as we have seen above, there may possibly have been Christians in the first half of the third century, but the evidence is not sufficient for us to

⁶³ *Ibid.*, p. 735; Rae, *The Syrian Church in India*, pp. 154f.

⁶⁴ Weber, *Krishnajanmāshatamī*, p. 322.

⁶⁵ Kessler, *op. cit.*, p. 733.

make this assertion definitely. There are no Nestorian Christians farther in the interior of northern India before the seventh century.

We may expect *a priori* to find Christian influences in Buddhist Sanskrit literature before we do in the Brahman because the Indian borderland was entirely Buddhistic in the first centuries of our era, and moreover foreign elements of a homogeneous character would be able to enter more easily into cosmopolitan Buddhism than into nationalistic Brahmanism. It will be well to keep this fact before our eyes, especially in judging early Krishnaism.

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SENSATION AND IMAGINATION.

OF all the direct two-term relations which can subsist between subjects and other entities, of the kind with which theory of knowledge is concerned, *acquaintance* is the most comprehensive. I do not mean that this is *a priori* necessary, but that, so far as can be seen by observation, it is in fact true. If an instance to the contrary could be established, no prejudice ought to prevent us from admitting the instance; in the absence of such an instance, however, I shall assume that all direct two-term relations of a subject to other entities, in so far as such relations can be directly experienced by the subject in question, imply acquaintance with those other entities. There are various words, such as sensation, imagination, conception, immediate memory, which denote two-term relations of subject and object, and we have to inquire whether these are distinguished by the nature of the relation or only by the nature of the object. Differences in the object (except when the object is mental) do not directly concern theory of knowledge, at any rate in its analytical portion; but differences in the *relation* to the object do directly concern the analytical portion of theory of knowledge. In the present article, we have to consider whether the difference between sensation and imagination is a difference in the object or in the relation.

The epistemological importance and difficulty of this inquiry have not, I think, been sufficiently appreciated by

any writer except Hume; and even Hume, though aware of the problem, offers a quite unduly simple solution. What is required is to find a tenable interpretation of the feeling that objects of sense are "real" while objects of imagination are "imaginary" or "unreal." In accordance with the maxim explained in our last article, it is not open to us to say that the objects of imagination are "unreal"; the whole conception of "reality" or "unreality," "existence" or "non-existence," as applied to particulars, is a result of logical confusion between names and descriptions. A color visualized, or a sound heard in imagination, must be just on the same level as regards "reality" as a color seen or a sound heard in sensation: it must be equally one of the particulars which would have to be enumerated in an inventory of the universe. Nevertheless, there is undoubtedly *some* important difference between sense-data and imagination-data, which is confusedly indicated by calling the former "real" and the latter "unreal." One outcome of this difference is that sense-data, but not imagination-data, are relevant to physics, being in fact that part of the material world which is immediately given. It is therefore of the utmost importance to epistemology to decide both how imagination and sense are distinguished, and what is the basis for the difference which we feel as regards their power of giving information about the material world.

In the first half of this inquiry, the following criterion will be useful. If we can find a case where the object is the same in two experiences which yet differ intrinsically, then the two experiences must involve different relations to the object. Thus if an object O can be given either in sensation or in imagination, and if the two experiences can be seen to be different by mere inspection, without taking account of their relations to other experiences, then we must conclude that sensation is a different relation from imagination. For two complexes which involve the same

related terms can only differ if the relations differ in the two complexes. If, on the other hand, it should appear that, whenever the object is given, sensation and imagination become intrinsically indistinguishable, we shall conclude that the relation involved is the same in both. If, lastly, we find that the object of sensation is never identical with the object of imagination, then our criterion fails; but in this case we at least know that the difference in their objects is quite enough to account for the fact that sensation and imagination are distinguished, and that there is no logical necessity to suppose the relations different.

The use of the above criterion may be made clearer by considering the difference between belief and doubt on the one hand, and the difference between true and false belief on the other hand. If I first doubt a given proposition, and then believe it, the two experiences are quite different intrinsically, and therefore the relation involved must be different in the two cases. In the case of true and false belief, on the contrary, the objects must be different when the belief is true and when it is false; moreover inspection shows no other intrinsic difference between true and false beliefs except the difference of their objects. Hence we may conclude that belief is one relation to objects, which is the same in the case of true beliefs as in the case of false beliefs. We cannot, by the nature of the case, find a true belief and a false belief which have the same objects in the same order, and therefore the more stringent form of our test is inapplicable; but it is sufficiently nearly applicable to make it practically certain that true and false beliefs differ only as regards their objects.

In the case of sensation and imagination, I believe that sometimes, though rarely, their objects may be identical, and that then they are still intrinsically distinguishable. I conclude that different relations to objects are involved in the two cases, although the distinction is facilitated

partly by differences in their usual objects, and partly also by means of their external relations to other things. This is the proposition which I wish to establish in the present article.

Before we can advance, it is necessary to have a definition of sensation and imagination respectively. In this, the usual psychological accounts are not of much use to us, because, in the first place, they do not regard either sensation or imagination as involving a relation of subject and object, and in the second place, they assume, as a rule, a knowledge of physiology which, as explained in the preceding article, we must at our present stage do our best to ignore.

Thus Stout says:¹ "One characteristic mark of what we agree in calling sensation is its mode of production. It is caused by what we call a *stimulus*. A stimulus is always some condition, external to the nervous system itself and operating upon it." He proceeds to explain the importance of distinguishing the stimulus from the object of sense-perception. Thus the stimulus and its causal connection with the sensation are only known by means of a body of knowledge not derivable without much inference. The connection with a stimulus will not appear necessarily in any intrinsic quality of a sensation; and so far as I can discover, no intrinsic quality distinguishing sensations from other experiences is given by Stout.

What James says about sensation comes much nearer to giving us what we require. He says:

"Its [sensation's] function is that of mere *acquaintance* with a fact. Perception's function, on the other hand, is knowledge *about* a fact." (*Psychology*, II, p. 2.) Again: "As we can only think or talk about the relations of objects with which we have *acquaintance* already, we are forced to postulate a function in our thought whereby we first

¹ *Manual of Psychology*, p. 127.

become aware of the *bare immediate natures* by which our several objects are distinguished. This function is sensation" (*ibid.*, p. 3).

He does not discuss "acquaintance," and it would be unfair to assume that he means by it what we mean. Nevertheless, if we take him to mean what we mean, his statement is one which we can in a great measure accept, and which at least has the merit of giving an *intrinsic* character of sensation. But although sensation has the characteristic which he mentions, it would seem that other experiences also have this characteristic; for he identifies sensation with acquaintance, and we are in fact acquainted with objects logically similar to those of sensation in imagination and immediate memory, and with objects of another kind in conception and abstract thought. Thus some further characteristic is required to distinguish sensation from other kinds of acquaintance.

One obvious characteristic, which distinguishes sensation from conception and abstract thought, is that its objects are *particulars*. A particular is defined as an entity which can only enter into complexes as the subject of a predicate or as one of the terms of a relation, never as itself a predicate or a relation. This definition is purely logical, and introduces nothing belonging to theory of knowledge. Thus we may say that sensations are always cases of acquaintance with particulars. But this is still not a definition, since it fails to exclude imagination and immediate memory.

In the analysis of memory there are special difficulties, which make it doubtful how far it is to be included under acquaintance. But assuming that there is a kind of memory which involves acquaintance with its object, such memory may be distinguished from sensation and imagination by the fact that its object is given as in the past: there is a temporal relation of subject and object which is involved

in the actual experience of memory. Being in the past is not an intrinsic property of the object, but a relation to the subject; thus memory will have to be distinguished from sense and imagination as a different relation to objects, not as the same relation to different objects. This topic will be resumed in the next article; for the present, it is enough to observe that memory is excluded if we say that the acquaintance we are concerned with must not be with an object given as past.

Sensation and imagination together, therefore, may be defined as "acquaintance with particulars not given as earlier than the subject." What is meant by "given as earlier" is a question requiring discussion; for the present, we may say that we mean "having an immediately experienced relation to the subject of that kind which underlies our knowledge of the past." The further definition of this relation must be reserved for the next article.

Since no acquaintance with particulars given as future occurs, it might be thought that "particulars not given as earlier than the subject" might be identified with "particulars given as simultaneous with the subject." But such identification presupposes, what must not be assumed without discussion, that an experienced particular must be given as in some temporal relation with the subject. If this can be denied, we may find here an intrinsic difference between sense and imagination. It may be that in sense the object is given as "now," i. e., as simultaneous with the subject, whereas in imagination the object is given without any temporal relation to the subject, i. e., to the present time. It is difficult even to discuss this question without an analysis of our perception of time, but let us make the attempt.

The theory I wish to examine will maintain that, whatever time-relation may in fact subsist between the subject and an object which is imagined, no time-relation is implied

by the mere fact that the imagining occurs. I do not know whether this theory is tenable or not, but I think there is more to be said in its favor than might be thought at first sight. I propose, therefore, to do what I can to make the theory seem *possible*, without coming to a decision as to its truth or falsehood.

It may be said that, while we are imagining, the object imagined may undergo processes of change—for example when we imagine a tune or when we mentally recite a poem. This of course is true, and might be thought to imply that the object must be contemporaneous with the imagining subject. But such an inference would be erroneous, as may be seen by the analogy of abstract thought. I may reflect that twice two are four, and then that twice three are six, and so on throughout the multiplication-table. In this case, I have different objects before my mind at different times, but none of the objects are themselves in time at all. In like manner, I may at one time imagine one object, at another time another object, or even at a continuous series of times a continuous series of objects—for example, the sound of a violin-string running down—while yet the objects imagined may be destitute of temporal position, or may have a temporal position which cannot be inferred from the fact that they are now imagined. An object imagined at one moment but not at another need not itself undergo any intrinsic change during the time between the two moments: it may merely cease to have that relation to the subject which consists in its being imagined. But such cessation may easily produce the belief that the object itself was at the time when it was imagined, though, as is clear in the case of abstract objects, this is in no way implied by the change that has occurred.

Consider, again, the kind of imagination which is connected with memory. In remembering, say, my breakfast this morning, I shall normally use images which are called

up at will and are said to be "of" my breakfast. It might be thought that in this case the object is in the past. But this would involve confusing the image with true memory. The image is not *identical* with the past sense-datum which it helps me to remember; and it is only when there is such identity that the object is in the past. I think in the case of *immediate* memory there is such identity, but in this case the object is not an image. When we use images as an aid in remembering, we judge that the images have a resemblance, of a certain sort, to certain past sense-data, enabling us to have knowledge by description concerning those sense-data, through acquaintance with the corresponding images together with a knowledge of the correspondence. The knowledge of the correspondence is obviously only possible through some knowledge, concerning the past, which is not dependent upon the images we now call up. This, however, belongs to the analysis of memory, which is not our present problem; for the present, all that is necessary to observe is that the images which are said to be "of" past sensible objects are not themselves in the past, and therefore form no objection to the hypothesis that images are not given in such a way as to enable us to assign a date to them.

One merit of the above theory is that it accounts, in a manner consistent with logic, for what is called the "unreality" of things merely imagined. This "unreality" will consist in their absence of date, which will also explain fully their irrelevance to physics.

If the above hypothesis is adopted, we can lay down the following definitions:

"Imagination" is acquaintance with particulars which are not given as having any temporal relation to the subject.

"Sensation" is acquaintance with particulars given as simultaneous with the subject.

It is to be observed that, in the above definition, it is not asserted that an object imagined has in actual fact no temporal relation to the subject, but merely that this temporal relation, if it exists, forms no part of the experience of imagining. The question whether this is the case or not must be capable of being decided by introspection, but introspection is difficult, and I cannot myself arrive at any certain conclusion in this way. We may observe, however, that "imagining" must not be held to include after-images, which, from our present point of view, belong rather to sensation; from the physiological point of view, also, they differ wholly from imagination, since they depend upon the recent stimulation of the sense-organ.

Leaving, for the present, this possible method of distinguishing sensation and imagination, let us consider other alleged differences. namely:

1. the physiological difference, in relation to stimulus,
2. the different relation to the will,
3. the less degree of vividness in images,
4. the different relation to belief and "physical reality."

We will consider these alleged differences successively.

1. The difference in causal relation to stimulus, as already pointed out, is one which is not relevant at our present stage; that is to say, if this were the only difference between sense and imagination, we should have to construct our theory of the knowledge of external reality before distinguishing between sense and imagination, since a knowledge of external reality is presupposed in the recognition of a different relation to stimulus. Now theories of our knowledge of external reality generally rely on sensation to the exclusion of imagination; hence unless we can invent a theory which uses both equally, we must not rest content with the proposed method of distinguishing between them. For this reason, it is important to examine other proposed distinctions.

2. It may be said that images are capable of being called up at will, in a way in which objects of sense are not. This, if true at all, is only true when stated with very careful limitations. We have at most times considerable choice as to what we shall see or touch, though of course we are limited to what is visible or palpable from where we are. As to what we shall imagine, we are limited by our imaginative powers, and though the field of choice is different, it is just as truly limited as in the case of sense. It is true that we can, more or less at will, call up images of past events, whereas in sense we are confined to what is at the present time. But this is a difference in the area of choice, not in the relation to the will. Moreover images may appear with just as little cooperation of the will as in the case of sensations. Stout, after explaining the sudden shock of a flash of lightning or a steam-whistle, says "no mere image ever does strike the mind in this manner" (*Manual*, p. 417). Macbeth speaks of

"that suggestion
Whose horrid image doth unfix my hair
And make my seated heart knock at my ribs
Against the use of nature."

The whistle of a railway engine could hardly have a stronger effect than this; and in morbid and insane states of mind images must frequently have the violence of sensations, with the same independence of the will. This distinction, therefore, cannot be accepted as adequate.

3. The view that images can be distinguished from objects of sense by their smaller degree of vividness has already been partly answered by anticipation under our previous heading. Stout sums up as follows:

"Our conclusion is that at bottom the distinction between image and percept, as respecting faint and vivid states, is based on a difference of quality. The percept has an aggressiveness which does not belong to the image.

It strikes the mind with varying degrees of force or liveliness according to the varying intensity of the stimulus. This degree of force or liveliness is part of what we ordinarily mean by the intensity of a sensation. But this constituent of the intensity of sensations is absent in mental imagery" (*Manual*, p. 419).

I believe this, however true as a general rule, to be liable to exceptions which make it quite useless as a test. A very strong emotion will often bring with it—especially where some future action or some undecided issue is involved—powerful, compelling images which may determine the whole course of life, sweeping aside all contrary solicitations to the will by their capacity for exclusively possessing the mind. And in all cases where images, originally recognized as such, gradually pass into hallucinations, there must be just that "force or liveliness" which is supposed to be always absent in imagination.

4. We may attempt to distinguish sensations from images by the belief in their "reality," in their power of giving knowledge of the "external world." This difference is hard to analyze or to state correctly, but in some sense it has plainly a large element of truth. Images are "imaginary"; in *some* sense, they are "unreal." They cannot be employed to give knowledge of physics. They are destitute of causal efficacy, they are not impenetrable, and altogether they fail to compel respect. But however true it may be that images differ from objects of sense in these respects, it is impossible that these differences should be the ultimate source of the difference between imagination and sense. The "unreality" of images requires interpretation: it cannot mean what we should express by "there's no such thing," for this phrase is only applicable to a thing described, not to a thing immediately given. The word "unreal," as applied to something immediately given, has always some rather complicated meaning. A visual object,

such as Macbeth's dagger or a reflection in a looking-glass, is "unreal" if it is not correlated with the usual tactile sensations; and the "unreality" of images might consist only in their not obeying the laws of motion and in their being generally unconventional in their behavior. But in any case, "unreality," as applied to objects of acquaintance, is some complicated conception, always derivative from some other difference between the objects so condemned and the objects recognized as "real." The difference, therefore, which undoubtedly exists between images and objects of sensation, in respect of our belief in their "reality," must be derivative from some other and simpler difference. If it be the case, as was suggested earlier, that images are not given as simultaneous or in any other time-relation with the subject, then an image need not exist at the moment when it is imagined, nor indeed at any other moment; such a difference as this, between images and objects of sense, would, it seems to me, amply account for the feeling that images are "unreal." This feeling, therefore, on examination, is found to afford a confirmation of our theory.

The case of dreams demands discussion: is dreaming sensation or imagination? The four differences which we have considered leave the matter doubtful. (1) Physiologically, in relation to stimulus, dreams cannot count as sensations, except in certain cases, e. g., where a door banging makes us dream of some noisy event such as a naval battle. In this case, the noise in the dream may be considered sensation, while the rest of the dream is taken as imagination together with false interpretation. But as a rule, for example with all the objects we see in dreams while our eyes are shut, the relation to stimulus which is supposed to be characteristic of sensation is absent. Thus as regards this criterion, the greater part of the objects in dreams would count as images. (2) As regards the

relation to the will, dreams belong rather with sensation. The procession of objects in a dream is received by us passively, in the same sense and to the same degree as the objects of waking sensation are received passively. But this difference between sense and imagination, we found, is by no means absolute: some images seem to come in just the way in which sensations come. Thus although, under this head, it would be more natural to put dreams with sensations, yet we cannot lay very much stress on this fact. (3) As regards the less degree of vividness of images, it would seem that dreams on the whole belong with images rather than with objects of sense. People, for example, whose visual images are not brightly colored, but are all of some dim shade of gray, are likely to see a similarly colorless world in their dreams, though often the power of visualizing in dreams will be more nearly that which the dreamer possessed in youth than that which he possesses now. Most people, I think, would say that the world of dreams has the fragmentary indistinctness of the world of images: it is fairly finished in the parts that specially interest the dreamer, but creation has been scamped elsewhere and it remains very much in the rough. It may be doubted, however, whether this is not equally true of the world of sense, and only seems untrue because we always pass away from sense to "physical reality" by an unconscious inference. What we see out of the corners of our eyes is very dim, but we do not feel it so, because as soon as we look at it straight we find it is distinct. Nevertheless, it must be admitted, I think, that as a general rule sensations have a vividness and distinctness which is lacking in imagination, and that in this respect dreams resemble imagination rather than sense. (4) What makes dreams really puzzling is their relation to belief and "physical reality." While they last, their relation to belief appears to be precisely that of sensation: they never seem, at the

moment, to be our own invention. Yet, when we wake, they are dismissed from belief on the ground that they do not fit in with our constructions of "physical reality." There is thus a conflict between belief (while we are dreaming) and "physical reality" (after we wake). As regards the belief, dreams belong with sense, while as regards the "physical reality" they belong with imagination. In this, dreams resemble hallucinations; they also resemble what we are told of the imagination of children, who sometimes, as Galton states,² "seem to spend years of difficulty distinguishing between the subjective and objective world."

The conclusion which is *suggested* by these considerations is that dreams belong mainly, but not wholly, to imagination, but are mistakenly supposed by the subject to belong to sensation even in their imagined parts. I do not mean that the subject, as a rule, definitely *judges* that they belong to sensation, but that his feelings towards them, while he is dreaming, are such as he would usually only have towards objects of sense, and such as he would cease to have if he recognized that the objects in question were mere images. In order that this theory may be tenable, it is not necessary to suppose that there is no intrinsic difference between imagining and sensating, but only that the difference is one which sometimes remains unfelt. If it is the case, as it seem to be, that a great majority of imagined objects differ in recognizable ways from sensible objects—by greater dimness, vagueness, subjection to our will, etc.—then it would be surprising if, when an imagined object fails to differ in these ways from an object of sense, the subject is mistakenly led to regard it as an object of sense, overlooking the less easily detected difference of relation which, if we are right, constitutes the true *differentia* of imagination. The way in which hallucinations

² Quoted by James, *Psychology*, II, p. 55.

and delusions often begin as mere vivid images, recognized as such, and only gradually acquire a hold on belief, suggests that, to the end, they remain different from sensations. Dreams will then be, in the main, identical in nature with hallucinations, and will be accounted for by the fact that in sleep our imagination is unusually active and our critical faculties unusually slight. All such experiences, which, if accompanied by belief, are recognized as sources of error, will be classed with imagination. With this conclusion, a great simplification will be introduced, at a later stage, into the problem of our knowledge of the external world.

If the hypothesis that images are not given in any time-relation to the subject is rejected, as perhaps it may have to be, it will be necessary to find some other way of explaining what is meant when images are said to be "unreal." We must in any case, I think, allow that imagination and sensation are different relations to objects, since, in spite of the differences usually to be found between images and sense-data, the difference between the two experiences of imagining and sensating seems too clear and profound to be accounted for by such differences alone. It seems evident that, if images have any given time-relation to the subject, it must be that of simultaneity; hence in this respect they will be indistinguishable from sense-data. We cannot hope, therefore, in this case, to explain the "unreality" of images by the nature of the relation of imagining; and I do not think that there is anything in the *intrinsic* character of images by which we can explain it. We must, therefore, if we allow images to be simultaneous with the subject, define their "unreality" by means of their behavior and relations.

The "unreality" of images may, on our present hypothesis, be defined as consisting merely in their failure to fulfil the correlations which are fulfilled by sense-data. An

imagined visual object cannot be touched, that is to say, if we perform those movements which, in the case of a visual sense-datum, would procure a sensation of touch, we shall not have a sensation of touch, nor, as a rule, an image of touch. Again, images change in ways which are wholly contrary to the laws of physics; the laws of their changes seem, in fact, to be psychological rather than physical, involving reference to such matters as the subject's thoughts and desires. This would, I think, sufficiently explain what is meant by the "unreality" of images. I do not, therefore, know how to decide between our present and our former hypothesis as to the nature of imagination.

We may now sum up the above discussion. In spite of certain differences usually to be found between images and sense-data, we decided that there is also a difference, usually recognizable introspectively, between the relation of imagining and the relation of sensating. We failed to find any way of deciding between the view that an image is given as simultaneous with the subject and the view that it is not given as in any time-relation to the subject. If it is given as simultaneous with the subject, its "unreality" must consist merely in its failure to obey the laws of correlation and change which are obeyed by sense-data and which form the empirical basis of physics. If, on the other hand, imagination involves no time-relation of subject and object, then it is a simpler relation than sensation, being, in fact, merely *acquaintance with particulars*. The object imagined may, on this view, have any position in time or none, so far as the mere fact of its being imagined is concerned. *Sensation*, on the other hand, is a relation to a particular which involves simultaneity between subject and object. Sensation *implies* acquaintance with the object, but is not identical with acquaintance. It is not a definition of sensation to say that it is acquaintance with an object which is in fact simultaneous with the subject: the simul-

taneity must be not merely a fact, but must be deducible from the nature of the experience involved in sensation. We might take sensation as indefinable, and define simultaneity by its means; but whether this is really feasible is a question which must be postponed until we come to consider our experience of time-relations. The "unreality" of images, which cannot be taken in a strict sense, may, we found, on this theory, be interpreted as expressing the fact that they are not given with any definite position in time. Dreams and hallucinations, we found, are to be classed, mainly, though not wholly, with images, and the mistaken view that they are sensations, which is normally held by the experiencing subject, may be accounted for by the fact that their objects have characteristics generally associated with objects of sense.

The next problem which must occupy us is a problem raised by our definition of sensation, and involved in any theory of memory, namely the problem of our acquaintance with time-relations. This problem will occupy us in the next article.

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ORTHODOX AND LIBERAL CHRISTIANITY.

A VIA MEDIA.

THE Christian church—using that term in its most comprehensive sense—is to-day divided into two great parties. It may, perhaps, be difficult to get a name for each that will satisfy both parties. Those I mean by “orthodox” perhaps would object to the word as misleading and would describe by it what is known in church history as the great movement in the seventeenth century known as orthodoxy. Liberalism does not so much oppose this as ignore it as almost beneath notice. This old traditional orthodoxy is, therefore, dead and need not be here considered. Those who inherit the orthodox tradition call themselves the Positive School, and stand opposed to the Liberal School. This is the real antithesis in Germany, and more or less in this country as well. The outstanding differences between the two schools are not difficult to trace. According to the Positive school, which inherits the orthodox tradition, Christianity is a great cosmic scheme of redemption, the fundamental presupposition of which is the fall of man, and the fundamental fact of which is that Jesus Christ is a Saviour or Redeemer. According to the second, Christianity is an ethical system of teaching or precept, and Jesus Christ is the supreme teacher and moral and spiritual guide. According to the first the important thing about Jesus Christ is what he did; according to the second what he taught. To the one Jesus Christ is supreme be-

cause of the act of atonement accomplished once and once for all on the cross of Calvary; to the other, because of what he revealed in his teachings as to the character of God and the nature of man. To the one the apostle Paul is the expositor *par excellence* of what Christianity is because he sets it forth as a great redemptive scheme; to the other the synoptic Gospels are the supreme authority because they contain, it is presumed, the ethical and spiritual teaching man needs for his guidance. The one believes that Christianity stands or falls with the supremacy of the apostle Paul, the other believes that we have really outgrown the speculations of the apostle Paul, and that we must fall back upon the teaching of Jesus in the first three Gospels.

It is obvious that orthodox or positive Christianity has practically the whole Christian church on its side, past and present. This does not of course settle the question, for in many things the Christian church has been mistaken. But it is well that we should be aware what a radical change is involved in the transfer from the one position to the other. If it were possible to ask any one of the great fathers of the church the question, what is Christianity? the answer would not be doubtful. They would have said, Christianity is the religion of redemption, and what is most vital in it is contained in whatever is essential and permanent in the doctrine of the incarnation and atonement of the superpersonal Son of God. As we know it, and as the church has known it, Christianity is the religion of St. Paul. Such certainly would have been the answer of St. Athanasius, the father who gave shape to the first great creed of the church,—the Nicene, which was formulated in the first ecumenical council assembled at Nicæa in 325 A. D., at the command of Constantine, the first Christian emperor. He would not have understood any Christianity

that had not its fundamental starting point in the incarnation of the Son of God and did not culminate in his death. The essence of Christianity, according to the Nicene conception of it, does not consist in any ethical teaching about God or man, but in God becoming man in Christ in order that man might become God. The same idea would have been given by St. Augustine, the greatest of the fathers of the west, whose teachings made possible the western or Latin church, and whose theology was embodied four centuries later in the Athanasian creed. He would not, perhaps, have put the matter in exactly the same form as did St. Athanasius, but in so far forth as emphasis on the redemptive character of Christianity is concerned the two fathers would have been at one. In the same line of teaching would have been St. Thomas Aquinas, Duns Scotus, and indeed all the great theologians of the middle ages. And when we come across the line that separates the ancient from the modern world, and enter the churches of the Reformation, we find essentially the same teaching, that Christianity is a redemptive system having its vital center in the death of the Son of God. Luther, Calvin, Knox, Cranmer, all the heroes of the Reformation, were at one with the pre-Reformation church in so regarding Christianity, however much they may have differed from it in matters not so vital. None of them would have recognized or understood a Christianity whose essence consisted in the precepts of the Sermon on the Mount, and not in the death of the Son of God on the cross.

It is only in comparatively recent times that the attempt has been made to conceive Christianity as a body of ethical and spiritual teaching, it originated with liberal Christianity which began its course by repudiating the Christ of the church in the interest of the Jesus of the synoptic Gospels, whom it conceived as historical. Its cry was "Back to Jesus." Let us be done with the doctrines of the church;

the Christianity we want and which the world needs is the Christianity which Jesus himself taught in the Galilean villages, and which has come down to us in his parables and precepts. Comparisons were drawn between the creeds of the pre-Reformation and Reformation churches and the teaching of the Master, always to the disparagement of the former in favor of the latter, and the promise was sometimes held out that the ultimate form of Christianity would be what was called the "simple teaching of Jesus." The most important duty was thought to be the return to primitive Christianity, and the wiping out of all the creeds of the intervening centuries as so much useless speculation. And inasmuch as the apostle Paul was the first and arch-offender, in that it was he who led the infant church away from the teaching of Jesus into dependence upon the death of Christ, the first duty was to repudiate the apostle Paul.

Paul's Epistles have thus been the *bête noire* of liberal theologians, and his fundamental blunder was the fall of man. This was put forth in the interest of optimism, and as being in harmony with the doctrine of evolution. It was not seen that it was essentially pessimistic and ran counter to the evolutionary theory, in that it invited us to see as the Christian centuries evolved the progressive obscuration of Christianity by Greek philosophy, and by the other products of secular culture, and not the progressive rational development and ever richer unfolding of the essential truth at the heart of the faith. It is not that the church has not attached importance to the teaching of Jesus, in which is set forth the nature of the kingdom of God, the transformation of the inner life of man which is necessary for entrance into that kingdom, the duty of self-denial, of self-sacrifice, of purity, of forgiveness. All this the church has held and taught was a vital part of Christianity, and must enter into the religion of the future as an integral part of it; but at the same time all branches of the church have main-

tained that the moral and spiritual teachings of Jesus are not so essential to mature Christianity as the doctrine of the death of Christ on the cross. It would seem as if some sure and vital instinct has held the heart of the church true to this central fact; no heresy has been deemed so deadly as a denial of the efficacy of the death of Christ for human salvation. The late Dr. Dale of Birmingham held that the essential Christian gospel is not found in the ethical teachings of the synoptic Gospels; that we must go to the Epistles to find it, for the reason that the essential gospel was something which God had done for man, and not simply moral and spiritual teaching, however pure it might be, which men were to follow and obey. The essential gospel of Christianity is involved in something God has done for man, and not in something said by Jesus to man. And what God has done for man has its culmination in what Jesus did on the cross of Calvary; and hence with a sure instinct the church has followed the apostle Paul rather than the synoptic Gospels. And yet it is not necessary to put the apostle Paul and the teaching of Jesus in opposition and contrast as has so often been done; it is only necessary to see that in the light of the death of Jesus alone can his teaching be seen in its most genuine significance.

When the Gospels are properly read they culminate in the death of their central figure. It is not the Epistles of Paul alone that emphasize the death of Jesus. From the very first he has his face set toward Jerusalem where he is to die. The cross is the center of the Gospels no less than of the Epistles. It is therefore a false contrast which liberal Christianity constantly draws between Paul and Jesus. It was a true instinct that enabled the artist to see the "shadow of the cross" in the carpenter's shop at Nazareth. For the whole evangelic story has both its meaning and culmination in the cross. Especially is this seen when

the non-Markan source of Matthew and Luke, which the critics call "Q" is separated from the rest of the Gospels. Evidently this is a part of the Gospels of which neither Matthew nor Luke is the author. It is common to them both; they have each of them adapted it to their purposes; it existed before they touched it substantially as it exists now. There are slight variations in the way in which each evangelist quotes this non-Markan source, but they are so slight that there is no doubt that it was the same document from which the two borrowed. Matthew best preserves the language and Luke the order of the original source. It contains no history, has nothing about the death or resurrection of Jesus. It has no record of any miracle wrought by him. It is almost wholly impersonal and ethical. It is the latest form of the "*irreducible minimum*" to which research has driven the higher criticism of the New Testament in its search for the origin of Christianity in the teaching of Jesus. A very high value is attached to it by the liberal critics because of the witness the fragment is supposed to bear to the reality of the life and teaching of Jesus. It is, so the critics tell us, the oldest fragment in the Gospels. It can be separated from the rest of the Gospels of Matthew and Luke. For long the critics have been convinced that the Gospel of Mark was the earliest source of our knowledge of Jesus, but now they are as convinced that "Q" antedates anything we have in the Gospels. The great value of this document consists in the fact that it tells us what were the teachings of Jesus. Says Dr. C. H. Gilbert, an American liberal critic, in a recent issue of the *Hibbert Journal*, "Of this teaching the earliest, the most various, and complete collection is that which is designated by the letter 'Q.'" "It is the most authoritative document," he tells us, "on the nature and scope of Christianity" just because it is supposed to be a collection of the words of Jesus. "No part of the New Testament is of the same

weight as the words of Jesus, him out of the fulness of whose spiritual forces the Christian movement sprang." When this non-Markan source is removed from the Gospels of Matthew and Luke, what is left behind bears almost as much testimony to the death of Jesus as do the Epistles of Paul. It is dominated by the Pauline point of view, and contains many Pauline elements. The Gospel of Mark is decidedly Pauline, and the Gospel of Mark is the substratum of those of Matthew and Luke. They follow Mark in so far as they relate historical facts, with the exception of the nativity stories which are not in Mark. They vary the story as they tell it, but the substance is Markan. The attempt, therefore, of the liberal critics to put Paul in opposition to Jesus breaks down, for Mark, Matthew and Luke all alike point to the death of Jesus as that on which all rests.

The attempt to find in "Q" the *fons et origo* of Christianity has a long history behind it, and it can be understood only in the light of that history. It is really a part of the controversy between the Roman church and Protestantism that arose with the Reformation, and has been raging ever since. Where is the norm of true Christianity to be found by which to test the various forms of it that arise in the course of its history? The Roman church answers this question by its doctrine of development. There is no fixed norm; it exists in the church itself which was established by Jesus Christ; and the church has the power of declaring from time to time what the true Christianity is. There is at the heart of this claim of the Roman church a profound truth which no branch of Protestantism has yet accepted in its fulness. It is the truth that the church is a living organism,—a growing organization. Every Protestant church is based on the idea that somewhere the norm is to be found—and one sect differs from another according to its answer to the ques-

tion where? All the conflicts of the Protestant sects with one another have been around this one question. Those who claim to stand nearest to the Roman church—the Anglicans—agree with that church in so far as to say that the norm is not to be found in the New Testament, but in the subsequent centuries. A few years ago an influential party of the Church of England presented a petition to the Primate, praying that the variation in doctrine and ritual allowable in the Church of England should be confined to those which have the sanction of the first six centuries. The motive in the movement was to check the Romeward or papal tendencies in the church. The signatories believed that if a law was passed to the effect that no doctrine or ritual be allowed in the church except it had the sanction of the great fathers of the first six centuries, an end would be put to the doctrines and practices of the extreme ritualists, which had their origin in the middle ages. The signatories to this petition expressed special loyalty to the Nicene creed, which was framed in the fourth century. The more liberal clergymen and members of the Church of England delight to call themselves “Nicene men,” and there is an idea in many minds outside of that church that the liberal theology of the present day is a revival of the Greek theology embodied in the Nicene symbol. The watch-word of the Broad Church party for many years has been “Back to Nicæa.” Frederick Denison Maurice gave the start to this tendency many years ago now, in urging the desirability of a fuller study of the early theologians of Alexandria. The advice was followed, and liberal churchmen have found many resemblances between the theological renaissance of the present day and the views of the great fathers of the early Greek church. Certainly there is a freshness and breadth in the writings of Clement, Origin, and Athanasius not to be found in those of Augustine and the Doctors of the middle ages. But that

does not prove that we can return to Alexandrian Christianity and accept the Nicene Creed as our own, any more than we can go back to the ninth century and accept the Athanasian Creed as our own. The attempt to bind the church which is a living organism to any past age is an impossible task.

The non-sacerdotal or non-episcopal churches of the Reformation have sought for the norm of Christianity in the New Testament. Not at once indeed was this position taken. The Confession of Augsburg, the creed of the Lutheran church, which was drawn up by the Reformers themselves, fixed the limit beyond which genuine Christianity was not to be found at the fourth century. But all forms of Presbyterianism and Congregationalism have planted themselves on the New Testament. This is final, they said. To this law and testimony all must conform. The theology which alone can be a foundation of the church must be a Biblical theology. At first, all of the New Testament was supposed to be binding on the church; but it was soon discovered that the Epistles of Paul contained the germ of the errors into which the church had fallen, and therefore if the church was to be founded on pure doctrine it must find its basis in the Gospels only. Persecuted in this city those in search of the true norm of Christianity found that they must flee into another,—they must go still farther back. The higher criticism was born and introduced a new element into the problem. The Gospel of John was found not to be above suspicion. It was clearly seen not to be a biography of Jesus, and what was demanded by this party was a Christianity which Jesus himself preached, and certainly that was not found in the Gospel of John, which was manifestly a theological treatise based on the theology of Alexandria. The cry was "Back to Jesus," just as the cry of the Anglicans had been "Back to Nicæa." The real Jesus was to be found in the

synoptics, and most diligently have the synoptics been searched for the purpose of discovering this "real" Jesus. For a while the idea that the synoptics were the final resting-place of the church seemed to satisfy all parties, but soon it was discovered that the search could no more stop there than in the Nicene creed. The chief agent in making the discovery has been, of course, the higher criticism, as soon as it was applied to the solution of the synoptic problem.

It was some time before Christian scholars could bring themselves to apply the same methods of criticism which have proved so fruitful in the case of the Old Testament to the New. The feeling has been that the New Testament is a different kind of book from the Old, and consequently must be treated differently. The reason for that feeling doubtless was that the central figure of the New Testament is wholly different from any of the characters of the Old,—that they were human, and he divine,—and therefore the literature that deals with him must not be treated in the same way as the literature that deals with them. Very slowly has the conviction worked itself into the heart of Christian scholars that so far as methods of criticism are concerned there is really no difference between the Testaments, that not even a blank leaf separates them, and that the younger scripture is comprehended in the scope of the literature of the Hebrew people, that it is a natural product of the human mind, just as truly as the Old Testament is, carrying to their legitimate conclusions the ideas of the elder scripture. Not designedly indeed, but really though unconsciously, the purpose of the criticism of the New Testament, especially in Germany, has been to undermine the doctrine of the divinity of its central figure and to discover a human Jesus. The presupposition of the study has been that a thick accretion of tradition and superstition has gathered around his name, and the object of the criti-

cism has been to peel this off and to get at the realistic human figure. The triumph of the study would have been the denuding from the supernatural Christ of the church of all miraculous elements, and the reconstruction of the earthly history of the man Jesus. The supernatural features with which the Gospels clothe the figure the critics were convinced were not historical. One by one they were set aside—not only the manner in which he entered the world and left it, but all the deeds attributed to him that proved his divinity. The critic has been in search of a purely human Jesus and in "Q" he professes to have found him; for here is only impersonal and ethical teaching with no death on the cross and no resurrection from the dead.

But the Christ of the church is not such a Jesus. The important question is whether the Christian church can make the great change of belief which the acceptance of such a Jesus would involve and remain the Christian church. If the critic's evidence for his thesis is so overwhelming that it must be accepted—well, then it must; but it is important that the churches of Christendom should realize the kind of Jesus the critics are presenting them with, and the vast revolution in belief which it involves. It has often been remarked that all of Christianity was involved in the controversy between Athanasius and Arius, and that the victory gained at Nicæa was a victory for Christianity itself. But here would seem to be even a greater issue. Christianity from the beginning has been conceived as a redemptive scheme, the good news of a divine being coming down from heaven to rescue fallen man, the Christ or Saviour not being a member of the fallen race, but apart from it and superior to it. To make the Christ or Saviour a member of the race, no matter how specially endowed with moral and spiritual qualities, is to alter the whole conception and to tear out the heart of the evangelic story. The Christian church has never yet consented to put its Christ into the

same category as the prophets of the Old Testament or the philosophers of Greece, but this is just what will have to be done if the Jesus of the critics is to be accepted as the Christ. Here are the words of the critic already quoted: "They [the hundred verses more or less that make up the document called 'Q'] present Jesus as a great spiritual prophet, as one who was in the line of Isaiah and Jeremiah." It is true that Dr. Gilbert adds that Jesus is presented as the master of Isaiah and Jeremiah, but he is superior to them in the same way as Aristotle is superior to all others in the realm of philosophy. As the Stagirite is "master of them who know in the realm of philosophy, then he who spoke the words of 'Q' is master of all who know in the realm of ethics and religion." No one doubts that Aristotle was a man, strictly within the human range, as much so as any of those with whom he is compared, and no one doubts that Isaiah and Jeremiah were human beings. The root idea of "Q" as Dr. Gilbert reads it is that Jesus was a teacher, not a Redeemer or Saviour as the Christian church has all along conceived him. As a teacher he spoke "winged words" indeed, but he does nothing as a Redeemer or Saviour. No words of "Q" lead up to anything "generically different from the conception of a prophet, or beyond that of the supreme and final prophet." Nor is Dr. Gilbert alone in this. Says a brother critic, Prof. S. J. Case, "The Jesus of liberal theology is not a supernatural person, at least not in any real sense of that term as understood by the traditional Christology" (*The Historicity of Jesus*, p. 151). "Jesus can best and most truly be known as a man among men. The religion which has Jesus for its object is to be sharply distinguished from the personal religion of Jesus." It is now believed by the liberals that he did not set himself forward as an object of worship and reverence, but that his primary concern was to point men directly to God, the God whom he himself

worshiped. The author quotes Harnack, the leader of the liberals. "He desired no further belief in his person and no other attachment to it than is contained in the keeping of his commandments. . . . This feeling, praying, working, struggling, and suffering individual is a man who in the face of his God also associates himself with other men." (*What is Christianity*, p. 125.) The method in which the liberal critics defend the historicity of Jesus involves the same thing. It is significant that theologians of strict orthodoxy stand aloof from the discussion of this question as though it does not concern them. The old controversy was between liberal and orthodox, and it may be said that the latter is not altogether displeased to see his old enemy attacked. It had been gaining a victory all through the last century, and doubtless was beginning to think that it was master of the field. But the triumph is really a defeat, for it means the destruction of Christianity as Christianity has been known in all ages of its history. Professor von Soden, for example, in his pamphlet *Hat Jesus gelebt?* maintains that we are as little justified in asking whether Jesus lived as we would be in putting the same question with regard to Socrates or Alexander, and easily shows how absurd it would be to entertain any such doubt or to ask any such question. The Jesus whom Dr. Gilbert and Professors von Soden and Harnack and the critics generally would commend to us is not the Christ the Christian church has all along believed in, and it is not the Christ it believes in today. If Jesus was a man as Socrates, Alexander, Isaiah, and Jeremiah were men, then the whole Christian world has been under a delusion. The discovery that Jesus was a man merely as those named were men, would be regarded as destructive of Christianity just as would be the discovery that Jesus never lived at all. It would be the destruction of Christianity as Christianity has been understood by the great saints and theologians

of the past, and as it is understood today by the Greek Church, by the Lutheran Church, by the Congregational churches of all lands, and by all branches of the Presbyterian Church.

The evidence is lacking that "Q" is the utterance of an individual Jesus. The greatest part of it is made up of ethical teaching which might have come from a Hebrew prophet. It is Hebrew ethics at their best. There is nothing that might not have come from a Hebrew prophet, and there is no personal claim put forth by the speaker. There is nothing against the supposition that the teaching was put into the mouth of Jesus by those who worshiped him as a God. Suppose that the story of a historical Jesus did not arise until after the destruction of Jerusalem in the year 70 A. D. Then there would be need of something to take the place of the old Jewish hierarchy in the new religion. The new faith would have to speak with the voice of authority, just as there would have to be something in it which would take the place of the stories of the suffering and dying gods of the East which had flooded the whole Greco-Roman world. To put teaching into the mouth of some hero or prophet or Messiah of the past was the universal custom of the time, and was not considered reprehensible as we would consider it today. The whole Old Testament is the evidence of this fact, for almost all of it is pseudepigraphic. It is not our business either to approve or condemn the literary practice of the first or second century, but simply to understand it; this in any case was what the evangelists Matthew and Luke did with the document the critics call "Q"; what they put into their Gospels was borrowed from somewhere. Dr. Gerald Friedländer in his *Jewish Sources of the Sermon on the Mount*, shows that the precepts of the sermon and the petitions of the Lord's prayer are derived from the Old Testament. Professor Pfeleiderer shows that Matt. xi. 25ff, on which the

liberal critics depend for proof of the personal note which is absent from all the rest of "Q", is part of a Christological hymn which betrays its ecclesiastical origin in its artistic metrical form. "The artistic arrangement of strophes in something like a sonnet-like form points to the moulding hand of the church." And the contents of the passage show that it was derived from earlier utterances from Paul, Cor. i. 19, "For it is written, I will destroy the wisdom of the wise, and will bring to nothing the understanding of the prudent." And Paul's thought was a familiar one in all the mystery institutions of antiquity, that it is only to specially endowed persons or specially prepared persons, initiated ones, that the higher truths were revealed. "It is just this specifically Pauline thought—that the true knowledge of God and of Christ is hidden from the natural man and only revealed to the mind of man by the Spirit of God, who is the Spirit of the Son of God—which the Evangelist makes (verse 22) Jesus himself express in words which are so strongly distinguished by their dogmatic character from Jesus's usual manner of speaking in the synoptic Gospels, and have such a remarkable affinity with the Pauline and Johannine theology (John i. 18; x. 5; xii. 3; xvii. 10) that one can hardly avoid the impression that we have here, not so much a saying of Jesus himself, as a Christological confession of the apostolic community in the form of a solemn liturgical hymn." (*Primitive Christianity*, II, p. 144). As elsewhere in the New Testament the critics fail to find the *fons et origo* of Christianity in "Q." If there is no death and resurrection of Jesus in "Q" there is no Christianity in it as Christianity has been understood in all the ages of its history, there is only Jewish ethics.

The one fallacy that runs through the whole liberal criticism of orthodox Christianity is the supposition that nothing can be true that is not historically true. The pre-

supposition of the Pauline conception of redemption is the fall of man; but science has proved that man never fell, and besides, it is said, there is no mention of a fall in the teaching of Jesus. But is the fall of man something that can be taught by science? What an immense assumption it is that it was a fact of science which the Spirit of Truth was wishful to teach in the story of the Garden of Eden! Suppose that there is much more in the old dogmas of the church than even the devoted believers in them imagine? Suppose that Paul, when he said "All have sinned and come short of the glory of God," did not refer to anything that took place on the plane of history? Suppose that he knew quite as well as the modern tyro in science that man was not created perfect in body and mind? Suppose that the old story of the fall did not mean what the seventeenth century divines imagined? Suppose that it is an allegory or symbol having a spiritual or esoteric meaning, that the sphere with which it deals is the super-historical sphere—a very real sphere to the apostle Paul—that the fall denotes, therefore, a fact in the spiritual life of man, not only of the first man, but of every man. The inference drawn by many in our day that the ancient writers who told the story of the fall were either fools for giving such idle tales, or men who did not know what they were talking about, because, forsooth, they were ignorant of the story of physical science—was too hasty. Perhaps these men were wiser than our modern theologian or man of science. Perhaps the story enshrines some deep-seated reality which is borne witness to by human experience. This would seem likely, because the story has satisfied the needs of multitudes of men and women, and these not the weakest of the race, but some of the strongest both intellectually and spiritually. These men and women have believed the story, not because in going back into the centuries they have come upon a perfect man, but because

looking within they have come upon certain facts of spiritual experience which the old story seemed to explain. Perhaps the ancient authors had not the remotest intention of teaching anything about man's first condition on the planet. Be that as it may, these facts of inner spiritual experience are as open to us as they were to him, and we should read the old story in the light of them and not in the light of any facts of physical science.

Every man feels within himself that he has fallen below the standard which he has set up for himself; he has not been the man he ought to have been. Theologians have called this fact of universal experience the sense of sin, and nothing is so wide spread as this sense of sin. It is not confined to Christian lands, therefore it cannot be the product of Christian theology. It must be something innate, something that belongs to man as man, as an inhabitant of this planet. It does seem that man could be better and greater than he is now, that his ideal is higher than his real. Wherever man is found he seems discontented with himself, as though he had fallen from some high estate. His reach always exceeds his grasp; he is always attempting more than he can accomplish, beginning tasks he cannot end. The soul of man is never satisfied with any achievements; it always aims at more than it can perform, always imagines more than it can accomplish, as though it had come from a higher realm and was greater than it seems. If we look deeply into the soul of any earnest man we shall find this in proportion to his earnestness. The apostle Paul found a contradiction in his nature,—while he was obedient to the law of God after the inward man there was another law in his members that brought him into captivity to the law of sin and death. The apostle of science, Thomas Henry Huxley, found the same thing—the course of cosmic evolution setting in one direction and man setting himself against it in another direction. What

is the explanation of the fact that man is in incessant conflict with himself? It would be explained were it true that the soul, the real man within, is not the product of cosmic evolution, but has come from a higher world into this lower one, that man is really a spiritual being or immortal essence tabernacling in mortal flesh.

Suppose that it were true what religious faith in every age and land has affirmed, that the soul of man has come from afar, from God who is its true home, and that here it has no abiding dwelling place, and is moving about, as Wordsworth expresses it, in worlds not realized? That would explain all these spiritual experiences just mentioned. How would it be possible to express such a truth otherwise than by saying that man has fallen from some higher world, that this world in which he is now is not his true home, and that here he is not living his true life? That is exactly what the apostle Paul means by "death," that man's condition in this world is a state of separation from the divine consciousness in a higher world. He means that man fell from that high estate when he came into this world of matter and form. The soul came from this upper realm, and this upper realm is the true home of the soul for which it yearns. The essence of the fall of man was the awakening within man of a desire for a separate life. How shall we speak of the soul in its own celestial home before it became incarnate in mortal guise? If we do speak at all of it it must be in the language of symbol and parable, for on such a theme the literal truth will not be possible for us. And what better symbol or parable could be found than that of Eden, if only we remember that no garden of earth is meant, no condition of physical perfection, but the soul's home in God. Its consciousness was one with the divine consciousness; it had no will separate from the will of God. What a confirmation of the Pauline doctrine of the fall is the one fact that comes out of every

scripture and every mythology the world over,—that the man that is, is a degeneration of the man that was. In Plato we have allegory upon allegory describing the soul of man before the fall in its heavenly home, and its condition in this lower world. The soul here is like a dweller in an underground den, with chains on legs and arms and neck, sitting with back to the light, seeing nothing but the shadows of things passing before it on a wall in front. Or it is, as it were, living at the bottom of the sea. And the great master tries to describe what a wondrous world would meet the eye could the soul come to the surface as fish sometimes come to the surface of the sea.—“A world whose mountains, stones, our emeralds, and sardonyxes, and jaspers, being but chips from them—a sun ever shining, never dimmed,

“All that is most beauteous imagined there,
In happier beauty, more pellucid streams,
An ampler ether, a diviner air,
And fields invested with purpureal gleams,
Climes which the sun who sheds the brightest ray
Earth knows is all unworthy to survey.”

The world, in fine, of the unfallen soul where, as Plato expresses it, are “Temples and sacred places in which the gods really dwell, and the denizens of this radiant world hear the voices of the gods, and receive their answers, and are conscious of them and hold converse with them;” and they see, continues Plato, “the sun, moon, and stars, as they really are, and their other blessedness is of a piece with this” (Churton Collins, *Poetry and Criticism*, pp. 268-9).

We have an echo of this Platonic doctrine in Paul's declaration, “For you died, and your life is hid with Christ in God” (Col. iii. 3). The “dead” of Paul were those who had fallen from the plane of true being, this higher realm of which Plato speaks, into the realm of matter and form. This is the natural condition of man in this world. There

is indeed no historic fall—science has set that aside—but Paul's doctrine still stands as the fundamental presupposition of the doctrine of redemption of which the New Testament is full.

Now what is true of the doctrine of the fall is true of the orthodox system as a whole. That system in its entirety constitutes one of the most complete and impressive products of the human mind. Hebrew prophetism, Greek philosophy and Oriental mysticism furnished the materials for it. Its central feature is the story of the deliverer who is to undo the ruin of the fall. A promise was given close upon that catastrophe by God himself that a deliverer would come in his own good time, who would redeem at least some of the children of Adam, and restore them to their original condition. There was a long preparation for his coming, and a long expectation on the part of the people. Finally the long looked-for era dawned, and an angel was sent to announce the advent. Strange stars were seen in the east heralding the approach of the wondrous child, and a heavenly choir sang anthems when he was born. His birth was of course supernatural as was fitting the work he had to do, and in his boyhood he showed marvelous wisdom. First of all he set himself to conquer the evil power of the universe for himself, to gain self-mastery and self-conquest. Then he set out in the plenitude of his strength, mighty in the kingship of his own nature, to conquer the evil of the world. No need to linger over the well-known story; it is known to all. The Christ at last is put to death as a sacrifice for the sin of the race. He is not a mere martyr to his convictions. He is the propitiation for the sins of the whole world. And this is witnessed by his resurrection from the dead, and by his ascent to heaven and taking his place at the right hand of God. And the stupendous drama was to close by his second advent to earth at the end of the age, when he

would reign over a renovated earth in a perfect kingdom of God.

Now it is easy to marshal proofs to show that this story is not historical. Of course it is not. The critic has no difficulty in showing that all the supernatural features of the story are hundreds even thousands of years older than our era, which proves that we are not dealing with literal facts, but are in the presence of a story which the world has repeated to itself over and over again. It differs from many other myths in being "circumstantial enough and sober enough in tone to pass for an account of facts, and yet loaded with enough miracle, poetry, and submerged wisdom to take the place of a moral philosophy and present what seemed at the time an adequate ideal to the heart" (Professor Santayana). What heart can remain unmoved when it contemplates the millions that have found refuge in it, guidance in a perplexing world, strength and courage in days of weakness, solace in affliction and comfort in death. And it is true, though not historically true. Religious truth if it is to be taught at all must be taught by means of symbols. The history of these symbols is the history of the soul of man. The enlightenment which has made the discovery that the system is not historically true is not half enlightened enough. Indeed it takes little enlightenment to see that it is incompatible with the facts of science and history; it takes more enlightenment to grasp the moral facts of man's life from which it sprang, its ideal or true meaning, and its proper function in the world. It brings us face to face with the mystery and pathos of the life of man on earth. Far better than to point out the incompatibility of the scheme with the world as science and history disclose it, is to honor the unconscious piety that produced it, and to understand the deep religious needs it embodies and meets.

All this should warn us not to be too hasty in throwing

aside the stories of the virgin birth and physical resurrection, because they are not historical. One of the reasons why orthodox Christianity has been under the shadow within recent years and why liberal Christianity has flourished is the fact that the stories of the supernatural birth and miraculous resurrection have been discredited. They have been discovered to be legends or myths; and the effect of that discovery has been the reducing of Christianity from the religion of redemption to an ethical system. The doctrines of incarnation and atonement have been supposed to rest upon these stories, and when the foundation is taken away the building falls. But if Paul's doctrine of the fall still stands in spite of the triumph of the doctrine of evolution, his doctrine of redemption may also stand in spite of the fact that no educated person can any longer believe in the virgin birth and physical resurrection as historical facts. All the liberal critics are agreed that these two stories are not historical. If nothing can be vital in Christianity but what is left historical by the critics, then we are indeed in a parlous state, for it is very little they do leave us as historical. All that has made Christianity the religion of redemption they have surrendered. Is nothing real but what is historical? There is a type of mind that seems unable to understand that any story can be true, or of any value to the world, unless it be literally and historically true. But surely this is a shallow way of thinking which does not understand the working of the human mind, and does not look deeply into the nature of the myth which has enshrined some of the greatest truths of the world. The great master of myth was Plato, and when he wished to deal with the transcendent realities of life and religion—God, the soul, the good—transcendent because they cannot be realized adequately in experience, overleaping as they do, the limits of all possible experience—he used the myth, and not the language and method of

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science. That is because these truths are ideals of the reason and not of the logical understanding (to use the language of Kant) and cannot find their satisfaction in the details of actual life, as the latter can, but which are really aspirations and efforts after the ultimate reality. Myth, therefore, is the only method in which religion can teach its great truths, for the reason that these truths can never find either scientific proof or full embodiment. Man must however live and act as though they had both, otherwise his life and action have no basis and no stimulus. In reality, the ideas of the reason,—the concept of the soul, of God, of a God who is wise and good, of a universe that is intelligible,—never can have any concrete embodiment; it is the function of the myth to represent them as having concrete form. These representations are not true in the sense that the light they give

"Never was on sea or land,"

yet they are

"The fountain light of all our day,
A master light of all our seeing."

They

"Uphold us, cherish, and have power to make
Our noisy years seem moments in the being
Of the eternal silence."

They are

"truths that wake
To perish never...."

Let me use the words of the accomplished author of *The Myths of Plato*, Prof. J. A. Stewart, to make my meaning clear: "When a man asks himself, as he must, for the reason of the hope in which he struggles on in the ways prescribed by his faculties, he is fain to answer, 'Because I am an immortal soul, created with these faculties by a wise and good God, under whose government I live in a universe

which is his finished work.' This answer, according to Plato, as I read him, is the natural and legitimate expression of the 'sweet hope which guides the wayward thought of mortal men,' and the expression reacts on—gives strength and steadiness to—that which it expresses. It is a 'true answer' in the sense that man's life would come to naught if he did not act and think as if it were true. But soul, cosmos as completed system of the good, and God are not particular objects presented, along with other particular objects, in sensible experience. This the scientific understanding fails to grasp. When it tries to deal with them,—and it is ready enough to make the venture—it must needs envisage them, *more suo*, as though they were particular objects which could be brought under its categories in sensible experience. Then the question arises, Where are they? And the answer comes sooner or later, They are nowhere to be found. Thus science 'chills the sweet hope in which man lives,' by bringing the natural expression into discredit" (*Myths of Plato*, pp. 49-50). Because the ideas of reason which are the presuppositions of religion are aims, aspirations, ideals, and never can be embodied adequately in historical experience, Professor Santayana is justified in thus expressing himself: "Religious doctrines would do well to withdraw their pretension to be dealing with matters of fact. That pretension is not only the source of the conflicts of religion with science and of the vain and bitter conflicts of sects; it is also the cause of the impurity and incoherence of religion in the soul, when it seeks its sanctions in the sphere of reality, and forgets that its proper function is to express the ideal. For the dignity of religion, like that of poetry and of every moral ideal, lies precisely in its ideal adequacy, in its fit rendering of the meanings and values of life, in its anticipation of perfection; so that the excellence of religion is due to an idealization of experience which, while making

religion noble if treated as poetry, makes it necessarily false if treated as science. Its function is rather to draw from reality materials for an image of that ideal to which reality ought to conform, and to make us citizens, by anticipation, in the world we crave." (*Poetry and Religion*, pp. 5-6.) What is vital in Christianity, just because it is the religion of redemption, is not found in any historical facts. It is transcendent, that is to say, it overleaps the limits of all possible experience, and can find adequate expression only by means of myth and legend such as the critics tell us the stories of the virgin birth and physical resurrection are. These myths or legends, however, are not the foundation of the doctrines of incarnation and atonement which constitute the essence of the faith; they are, on the contrary, their product, and they can and will live when these stories are everywhere admitted to be legends or myths. To cast them away as valueless because they are myths or legends is to empty the most precious parts of the New Testament into the sea.

We have seen that the story of the fall cannot be historical. It is the symbol of a timeless fact in the history of man, taking place in every soul of the race—all the more true because not historically true. Its meaning is cosmic rather than historic. The story is not the foundation of the truth; the truth is the foundation of the story. Many other stories in other religions symbolize the same truth, but the truth is independent of them all and would stand were they all proved legends or myths. The presupposition of the Pauline doctrine of redemption, therefore, is not set aside with the discovery that there never was a historic Adam. We cannot tell whether Paul attached strict historicity to the Genesis story, but one thing is clear, such historicity is not necessary to the interpretation he gave it. By "Adam" Paul meant the man of flesh as distinguished from the man of spirit whom he symbolized

by "Christ." The question of the historicity of either Adam or Christ is a comparatively unimportant one; what is important is that he regarded both as factors in a cosmic process of development. Paul's great interest, all admit, was not the historic Jesus, but the heavenly Christ. He regarded the career of the historic Jesus as a mere episode in a life that was cosmic or universal, lived on a plane above the historical. The "Jesus Christ" of Paul has little resemblance to the partly historicized figure of the synoptic Gospels. He is a mystic being who was revealed within the soul of the apostle and who dwelt there as an abiding presence. He was a being who could be formed within the soul of the members of the church or community. It is difficult to believe that the churches or communities to whom Paul preached his view of a spiritual Christ revealed to him by his own ecstatic experiences and visions were derived from the church of Jerusalem of which Peter and James and John were the founders, and which were organized around the story of an historic Jesus. Paul was at open variance with these apostles and spoke of them as "pillar apostles" not in a very complimentary way. In the letters of Paul we are introduced to communities or churches entirely different from those which took the synoptic Gospels as their inspiration and guides. Paul does not follow the synoptic tradition. He follows a Christ of his own and speaks of his own gospel. To Paul the views of the "pillar apostles" seemed materialistic.

It is difficult to believe that there were any such record of the life and teaching of Jesus in existence as the synoptic Gospels contain in the possession of the church at Jerusalem; for with an authority such a record would imply, how could Paul have had any chance of successfully withstanding the "pillar apostles," or of persuading the communities or churches formed by them to leave them and

follow him? Paul's Epistles bear witness to churches or communities which had been long in existence when he visited them. He has no affinity with churches or communities that were based upon the tradition of a historical Jesus such as we have in the synoptic Gospels; but he has a very close affinity with those other churches or communities which believed in a mystic Christ, and whose technical terms were all derived from the Gnosticism which recent research has shown to be pre-Christian. Paul was not converted to a belief in a historical Jesus; he was changed from being an official persecutor of the messianic sects to a preacher of a mystic Christ or spiritual messiahship, which he did not derive from man. The Christ he preached was born of his own immediate experience and revelations. He did not go through the cities of the Mediterranean, Corinth, Ephesus, Colosse, and the province of Galatia, proclaiming that a great teacher had appeared in Palestine, and quoting from his teachings. His Epistles being witness, Paul lived in a different world from the Evangelists, and dealt with different subjects. The "Jesus Christ" with whom Paul deals in his Epistles is one who never did anything, never wrought a miracle, never performed a deed of mercy, and never uttered a word of teaching, but simply died and rose from the dead. That is to say, the Christ of the Pauline letters is not the Jesus of the Gospel story. The incidents of the Gospels are not the mental and spiritual background of his words and phrases, and give no clue to his meaning. What emerges clear as daylight from Paul's Epistles is that the churches or communities he established as well as those he found already established when going on his missionary journeys, were not communities organized around a historical Jesus; they were of a mystic nature resembling the Therapeutae of whom Philo speaks, or the Essenes, people devoted to the cultivation of the life of contemplation and of union with

God. It is not an unlikely assumption that it was with one of those communities that Paul spent his time after his conversion, and that it was the light and inspiration he received from that source which emboldened him to be the apostle he afterwards became. What we have in the synoptic Gospels is, in parts, teaching inferior, that is, lower in spiritual tone and insight than that current in the mystic sects to which Paul belonged and ministered. They believed in a Saviour who was a heavenly being; belief in the Logos was a fundamental part of their creed.

Paul's real background is the teachers of Greece and not the synoptic Gospels—the teachers of Greece as modified by the wisdom of Egypt. No one can read his Epistles with any degree of attention without seeing that Paul was a Jew who was greatly influenced by the mystical sects that had come in like a flood from the east and spread all over the Greco-Roman world in the first century of our era and before, and had profoundly modified the philosophy that had come from Greece. This amalgam, made up of Hellenism, Judaism, and Oriental mysticism, has received the name of Gnosticism. It was a very wide-spread tendency in the centuries preceding the beginning of our era, and assumed many different forms, so much so that it is difficult sometimes to see the common resemblance. Paul's language which was not derived from the synoptic tradition bears a close resemblance to the terms used in these various Gnostic sects scattered all over the East. Their teachings were termed "mysteries," and Paul speaks of "the mystery which was hid from ages and generations being now made manifest to the saints," of "the wisdom of God in a mystery, even the hidden mystery which God ordained before the world unto our glory." Instead of the letters of Paul being moulded upon the Gospel story, containing quotation and reference to miracle and parable and precept, they are saturated with the language of Gnos-

ticism, and repeat on almost every page the terms in common use in the mystery sects of his time. Especially is there a close resemblance between Paul's language and that of the literature of Hermes the Thrice Greatest, which is the key to the wisdom of Egypt, and which takes us back to the best in the mystery traditions of antiquity. The theme of all the treatises of that body of literature is the man-doctrine, the man-mystery, or man-myth. Briefly put it is the story of the descent of man from his heavenly home, and then his return to that state of glory after having mastered the powers of evil. There is nothing so ancient as this man-doctrine; it is lost in the mists of antiquity, and in the centuries immediately preceding our era it was a well developed doctrine in the whole Greco-Roman world. It was the jealously guarded secret of every mystery institution of the ancient world. It is a great hindrance to the understanding of the New Testament, especially the Epistles of Paul, that this man-doctrine of the ancient mystery institutions of antiquity as it is taught in the Sermons of the Thrice Greatest Hermes, is so little known. Perhaps this is not to be wondered at when we remember how recent is the discovery of the writings, and what a prejudice has been raised against them on account of their resemblance to the New Testament, as though they were worthless imitations of it. Professor Flinders Petrie in his *Personal Religion in Egypt Before Christianity* rightly says that as the treatises of Thrice Greatest Hermes are clearly earlier than the apostolic age, they are among the most needful for the understanding of the modes of thought of that time. The apostle Paul cannot be understood without an acquaintance with the sermons of Thrice Greatest Hermes. Here are found the terms which the apostle is constantly using. Paul has been a writer difficult to understand because he does not define his terms. But why should he define them when

he was using the terms of his predecessors and contemporaries well known to those to whom he wrote? In his Epistles we have echoes of what was taught in Egypt and Greece two or three hundred years before, which has come down to us in this body of literature. The apostle and the author of these treatises, are evidently, as Charlotte E. Woods rightly says in *The Gospel of Righteousness*, treating of the same deep mysteries and are anxious to make known the same spiritual truths.

When two writers use the same terms it is evident that they are dealing with the same theme. And the theme of both is the spiritual story of man—the eternal process or progress of man toward divinity. This is redemption; and redemption, no one needs to be told, is the theme of Paul. The goal of this process or progress is Christhood. In the literature of Hermes is set forth with Oriental imagery and symbol which often obscure by their abundance and splendor, the story of man which in the New Testament is the story of the Christ. It was the claim of the second century Gnostics that Christianity was none other than the consummation of the inner doctrine of the mystery institutions of all the nations. The end of them all was the revelation of the mystery of man which was hid, as Paul says, from ages and generations. And it is the same story that is taught in the Gospel records by means of a symbolic life. In the history and person of Christ we are to see a living prophetic picture of the final development of man. In Christ every man, therefore, possesses both the guarantee and the representation of his own destined perfection. In the Gospel story we are to see the birth of this inner man or Christ, his growth, his conflict with the lower nature, his gradual mastery of all lower forces, and his final triumph and glorification.

There was not, therefore, such a sudden break as has been supposed between paganism and Christianity; the lat-

ter did not come upon the world suddenly and miraculously like the rise of the sun at midnight; the two blended into each other with almost insensible gradations. There was, in this sense, a Christianity before Jesus, and all the characteristic ideas and terms such as we find in the pages of Paul and John,—Logos, Saviour, only-begotten, second birth, resurrection, mystery, etc., were in use in the pre-Christian Hermetic literature of Egypt. Plato taught that there were original patterns or models of all natural objects, existing in the divine mind prior to their creation. Especially was there an archetypal man. In one of the Hermetic books we have this text: "All-Father Mind, being life and light, did bring forth man co-equal to himself" (*Corpus Hermeticum*, I, li). This is essentially Platonic, for this "man" is not any actual man, but the archetypal or prototypal man, "the spiritual prototype of humanity and of every individual man." This archetypal man is very real though unhistorical. The idea or plan or model of an organ, a house, a steam-engine, is prior to its existence as a material fact, and is the real cause of its existence as a material fact. As there is an ideal leaf according to which the actual leaf is formed, so there is an ideal or archetypal man according to which every man is formed. Physical science emphasizes this fact in its doctrine of conformity to type. It is the ideal of the animal or plant that determines the direction of the particles that make and build up the animal or plant. The potential or archetypal oak within the acorn causes the entire growth of the tree. This enables us to understand the immanence of Christ as Paul conceived of it. Philo wrote with no knowledge of Christianity, "The first Son of God is the divine image or model of all else, the original species, the archetypal idea, the first measure of the universe, the heavenly man." The Kabbala teaches that the first account of the creation in Genesis refers, not to the creation of the actual world, but

to the perfect ideal world and to the ideal man. It was in the atmosphere of this ancient teaching that Paul lived. This is the key to his Christology. It is the missing link between him and his spiritual progenitors. Christ is the image and likeness of God, the divine pattern or archetype after which man's nature was fashioned. It is God's life in man, so that God not only dwells in man, but is the very basis and ideal of his being. When Paul said, "Other foundation can no man lay than that is laid which is Jesus Christ," he was not pointing to a historical Jesus, but to Christ, the archetypal man, who evolves within man.

The first great process in the manifestation of the divine life is that of involution. Spirit, the active principle, descends into matter, the receptive principle, and endows it with the qualities which we observe it is now possessed of. This endowment or descent is symbolized in the New Testament by the death of Christ. After his death his body according to the ancient symbolism is dismembered or scattered. "Now," says Paul, "ye are the body of Christ, and members in particular," which means that Christ dies and comes to life again in the souls of men. The fullest truth about human life is that it is the evolution of the archetypal man. The deepest mystery of creation is that it is the sacrifice of God himself, the Calvary of Deity. The cross did not mean to Paul merely or solely the death by crucifixion of the man Jesus. In the ancient world there was no symbol so wide spread as the symbol of the cross. It is obvious that it could not mean the death of Jesus which was a local happening; it meant the sacrifice of God in creation, the world-passion, Deity laying down his life in the universe of matter and form. And to Paul the cross was the symbol of this heart-moving conception. It was the power of God and the wisdom of God. The interpretation of Paul's determination not to know anything among men save Jesus Christ and him crucified

which makes him mean only that he would know nothing but the historical fact of the death of Jesus upon the cross of Golgotha eviscerates his message of all real content. The cross is the ground plan of the universe. To know the cross from this higher standpoint is to know all there is to know; there is nothing beyond it. This was the mystery hid from ages and generations but now made manifest. The divine sufferer was not a Jewish teacher merely, who by his revolutionary opinions proclaimed in the teeth of the authorities of his country and time had brought upon himself the death penalty. All this was but the symbol of a profound mystery which opened up the heart of Deity himself to the gaze of the world. The divine sufferer was God himself who in creating the universe sacrificed himself for it. The cross, therefore, represents the greatest of all sacrifices, not something that happened once, and once for all, but something that is eternal and timeless, the sacrifice of God in his own creation that could not be unless he poured his own life into it, and restricted himself within its forms and substance. Great is the mystery of the cross, unthinkable in its magnitude is this sacrifice, for it means nothing less than the identification of the infinite with the finite in its lowest forms. Here is the profoundest mystery open to human contemplation, to speak or think of which is possible only in forms of symbol and parable. The literal truth is too vast, too mysterious, too sublime to be made known to human comprehension. It is the mystery before which we are told the angels veil their faces; and to gain a single glimpse into it one may well surrender all other knowledge and determine, as Paul did, to know nothing else. Creation is nothing other than God's primal and continual self-revelation; it is the great Father coming down and voluntarily incarnating himself for us and for our salvation. The cross of Jesus is the parable of this infinitely larger truth. It testifies to the perpetual sacrifice

of Deity himself within his own universe. It is the Lamb slain from the foundation of the world, that is to say, prior to human history, the emblem of divine body and blood voluntarily sacrificed in outward physical nature and entombed deep in the lower consciousness of man destined one day to rise from the dead in power and great glory.

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NEWTON'S HYPOTHESES OF ETHER AND OF GRAVITATION FROM 1672 TO 1679.

IN preceding articles we have considered at some length the nature and growth of Newton's conception of mass. We have now to trace the fortunes of Newton's views on ether and on the connected question as to whether or no gravitation is an essential property of matter. Writers on mechanics have often unduly neglected the theories of the ether given in Newton's optical papers, and writers on optics have often overlooked the mechanical significance—which was continually emphasized by Newton himself—of theories of the ether. Many of the books referred to are the same as in my former articles on Newton in this magazine.

I.

The first well-known author to abandon the ancient emission theory of light was Descartes.¹ Three kinds of matter have, according to him, separated, in the course of the evolution of the universe, out of the homogeneous, boundless and continuous substance which constitutes space; and the sensation of light is caused by the transmission of pressure by the small spheres of the second kind of matter. Colors are caused by different velocities of rotation of these particles which they have in virtue of oblique pressure; the most rapid rotation giving rise to the sensa-

¹ Rosenberger, *op. cit.*, pp. 21-22; cf. E. T. Whittaker, *A History of the Theories of Aether and Electricity from the Age of Descartes to the Close of the Nineteenth Century*. Dublin and London, 1910, pp. 4-9.

tion of red, a slower one to that of yellow, and slower ones still to those of green and blue. The order of the colors was taken from the order of colors in the rainbow.

In contrast to the view of Descartes, Hooke's fundamental supposition was, according to Newton,² that "the parts of bodies when briskly agitated excite vibrations in the ether which are propagated every way from those bodies in straight lines, and cause a sensation of light by beating and dashing against the bottom of the eye; something after the manner that vibrations in the air cause a sensation of sound by beating against the organs of hearing." Again, to quote some later words of Newton, Hooke "changed Descartes's pressing or progressive motion of the medium to a vibrating one; the rotation of the globuli to the obliquation of the pulses, and the accelerating their rotation on the one hand, and retarding it on the other, by the quiescent medium to produce colors, to the like action of the medium on the two ends of his pulses for the same end."³

In fact, Hooke maintained that light is an actual motion and not, as Descartes did, a tendency to motion, and began the development of the undulatory theory. His hypothesis of colors (1667) was "that blue is an impression on the retina of an oblique and confused pulse of light, whose weakest part precedes and whose strongest follows."

Apart from these hypothetical considerations, it⁴ had long been known to every writer on optics and to every practical optician that lenses with spherical surfaces do not give distinct images of objects. This indistinctness

²Letter to Oldenburg of July 11, 1672; Horsley's edition of Newton's *Opera*, Vol. IV, pp. 325-326. Cf. § III below.

³This view of Descartes's theory and of Hooke's opinions was given by Newton in his letter to Oldenburg dated December 21, 1675; *General Dict.*, Vol. VII, p. 783; *Macclesfield Correspondence*, Vol. II, p. 378. Cf. Brewster, *op. cit.*, Vol. I, pp. 88-89, and the end of § IV below. A very full account of that part of Hooke's work on physical optics which antedates Newton's first optical memoir was given by Rosenberger, *op. cit.*, pp. 35-42. Cf. also Whitaker, *op. cit.*, pp. 10-15.

⁴Brewster, *op. cit.*, Vol. I, pp. 37-39.

was believed to arise solely from their spherical figure, in consequence of which the rays which passed through the marginal or outer parts of the lens were refracted to a focus nearer the lens than those which passed through its central parts. The distance between these foci was called the "spherical aberration" of the lens, and various methods were suggested for diminishing or removing this source of imperfection. Descartes had shown that hyperbolic lenses refracted the rays of light to a single focus, and accordingly we find the early volumes of the *Philosophical Transactions* filled with schemes for grinding and polishing lenses of this form. Newton had made the same attempt, but finding that a change of form produced very little change in the indistinctness of the image, he thought that the defect of lenses, and the consequent imperfection of telescopes, might arise from some other cause than the imperfect convergence of the incident rays to a single point. This conjecture was speedily confirmed by the brilliant discovery of the different refrangibilities of the rays of light. With regard to the views of the predecessors⁵ of Newton respecting the nature and origin of colors, Descartes held the opinion we have already mentioned; Grimaldi, Dechales, and others regarded them as arising from different degrees of rarefaction and condensation of light; and Gregory (1663) defined color to be the hue (*tinctura*) of igneous corpuscles emerging from radiant matter. When recounting the opinions of preceding writers, Newton alleged that in all of them the color is supposed not to be innate in light, but to be produced by the action of the bodies which reflect or refract it. This, however, said Brewster,⁶ is not strictly true. Isaac Voss, in a dissertation of 1662 which Newton probably never saw, distinctly maintained that all

⁵ An account of the theories of light and colors of Aristotle, Kepler, De Dominis, Marci, Descartes, Voss, Grimaldi, Hooke, Boyle, Barrow, and others was given by Rosenberger, *op. cit.*, pp. 11-45, 51-52.

⁶ Cf. Rosenberger's criticism, *ibid.*, pp. 25-26.

the colors exist in light itself, or, to use another of his expressions, that all light carries its colors along with it. This conjecture cannot however be regarded as in any way anticipating the great discovery of Newton, "that the modification of light from which colors take their origin is innate in light itself, and arises neither from reflection nor refraction, nor from the qualities or any other conditions of bodies whatever, and that it cannot be destroyed or in any way changed by them."

II.

Newton, in a letter of January 18, 1672, to Oldenburg, the secretary of the Royal Society, announced that he proposed to send, for the consideration of the Royal Society, an account of the discovery which led him to concentrate his attention on the making of reflecting⁷—and not refracting—telescopes, and which was, said he, "in my judgment the oddest, if not the most considerable, detection which hath hitherto been made in the operations of nature."⁸

Newton's letter of February 6 to Oldenburg, which contained an account of his theory of light and colors, was read on February 8 and printed in the *Philosophical Transactions*⁹ for February 19, both for the purpose of "having it well considered by philosophers," and for "securing the considerable notices thereof to the author against the arrogations of others." At the same time a committee, con-

⁷ Newton's constructions and exhibitions of, and controversies about, his reflecting telescopes were dealt with by Brewster, *op. cit.*, Vol. I, pp. 37-53, and Rosenberger, *op. cit.*, pp. 52-59.

⁸ *Isaaci Newtoni Opera quae exstant omnia*, ed. Samuel Horsley, Vol. IV, London, 1782, p. 274 (this will be referred to as *Horsley*); Thomas Birch, *The History of the Royal Society of London*,... Vol. III, London, 1757, p. 5; Brewster, *op. cit.*, Vol. I, pp. 71-72.

⁹ No. 80, February 19, 1672, pp. 3075 sqq.; *Phil. Trans., abr.*, Vol. I, pp. 134 sqq.; notice in Birch, *op. cit.*, p. 9; and Rosenberger, *op. cit.*, pp. 59-69. The letter was printed at length in *Horsley*, Vol. IV, pp. 295-308. Cf. Brewster, *op. cit.*, Vol. I, pp. 72-77; Rosenberger, *op. cit.*, pp. 59-69; Whittaker, *op. cit.*, pp. 15-16.

sisting of Seth Ward (Bishop of Salisbury), Boyle and Hooke, was appointed to peruse and consider it, and to give a report upon it to the Society.

Newton had, in the beginning of 1666, obtained a triangular prism, "to try therewith the celebrated phenomena of colors." For this purpose, "having darkened," as he expressed himself, "my chamber and made a small hole in my window-shuts to let in a convenient quantity of the sun's light, I placed my prism at his entrance, that it might be thereby refracted to the opposite wall. It was at first a very pleasing divertisement to view the vivid and intense colors produced thereby; but after a while applying myself to consider them more circumspectly, I became surprised to see them in an oblong form, which, according to the received laws of refractions, I expected should have been circular." The length of the colored spectrum was in fact about five times as great as its breadth. After more experiments, Newton found the explanation to be that ordinary white light is really a mixture of rays of every variety of color, and that the elongation of the spectrum is due to the differences in the refractive power of the glass for these different rays.

"Amidst these thoughts," said Newton,¹⁰ "I was forced from Cambridge by the intervening plague." This was in 1666,¹¹ and his memoir on the subject was not presented to the Royal Society until more than five years later. In it he propounded a theory of colors directly opposed to that of Hooke. "Colors," he said,¹² "are not qualifications of light, derived from refractions or reflections of natural bodies (as is generally believed), but original and connate properties, which in divers rays are divers. Some rays are disposed to exhibit a red color and no other, some a yellow and no other, some a green and no other, and so of

¹⁰ *Horsley*, Vol. IV, p. 300.

¹¹ Cf. my article in *The Monist* for April, 1914.

¹² *Horsley*, Vol. IV, pp. 301-302.

the rest. Nor are there only rays proper and particular to the more eminent colors, but even to all their intermediate gradations. To the same degree of refrangibility ever belongs the same color, and to the same color ever belongs the same degree of refrangibility. . . The species of color and degree of refrangibility proper to any particular sort of rays is not mutable by refraction nor by reflection from natural bodies, nor by any other cause that I could yet observe. When any one sort of rays hath been well parted from those of other kinds, it hath afterwards obstinately retained its color, notwithstanding my utmost endeavors to change it."

Not very far from the beginning of his experiments, Newton, in his own words,¹³ "began to suspect whether the rays, after their trajection through the prism, did not move in curve lines, and, according to their more or less curvity, tend to divers parts of the wall. And it increased my suspicion, when I remembered that I had often seen a tennis-ball, struck with an oblique racket, describe such a curve line. For, a circular as well as a progressive motion being communicated to it by that stroke, its parts, on that side where the motions conspire, must press and beat the contiguous air more violently than on the other, and there excite a reluctancy and reaction of the air proportionably greater. And for the same reason, if the rays of light should possibly be globular bodies, and by their oblique passage out of one medium into another acquire a circulating motion; they ought to feel the greater resistance from the ambient ether on that side where the motions conspire, and thence be continually bowed to the other." But he could not observe any such "curvity."

III.

The publication of Newton's memoir gave rise to an

¹³ *Horsley*, Vol. IV, pp. 297-298. Cf. *Rosenberger*, *op. cit.*, pp. 62-63.

acute controversy,¹⁴ and Hooke was among the foremost of Newton's adversaries. Indeed he was the only one who seems to have had an effect on Newton's views on the ether. It seems that this unpleasant controversy had much to do with the reluctance to publish his results which Newton ever afterwards showed. Hooke viewed Newton's discoveries through the medium of his own theory, and, when he sent in his report on February 15, 1672, he was thanked "for the pains he had taken in bringing in such ingenious reflections," but it was not "thought fit to print the two papers together, lest Mr. Newton should look upon it as a disrespect in printing so sudden a refutation of a discourse of his which had met with so much applause at the Society but a few days before."

In Hooke's report¹⁵ on Newton's communication, criticism was directed solely at the hypothetical part. He expressed his ready agreement with Newton's experiments and thought his hypothesis "very subtle and ingenious," but could not "think it to be the only hypothesis, nor so certain as mathematical demonstration." In the course of the report Hooke said: "But grant his first supposition, that light is a body and that as many colors as degrees thereof as there may be, so many sorts of bodies there may be, all which compounded together would make white, . . .";¹⁶ thus indicating that Hooke considered Newton's corpuscular hypothesis to be of some importance in Newton's doctrine of light and colors.

Newton replied to Hooke's criticism in a letter¹⁷ addressed to Oldenburg and dated July 11, 1672. As to the supposition attributed to him by Hooke, he replied:¹⁸ "It is

¹⁴ Cf. Brewster, *op. cit.*, Vol. I, pp. 77-86, 89-96; Rosenberger, *op. cit.*, pp. 73-101.

¹⁵ Birch, *op. cit.*, Vol. III, pp. 10-15; Rosenberger, *op. cit.*, pp. 73-75.

¹⁶ Birch, *op. cit.*, Vol. III, p. 14; Rosenberger, *op. cit.*, p. 74.

¹⁷ *Horsley*, Vol. IV, pp. 322-342; Rosenberger, *op. cit.*, pp. 75-82. Cf. Brewster, *op. cit.*, Vol. I, pp. 90-91.

¹⁸ *Horsley*, Vol. IV, pp. 324-326.

true that from my theory I argue the corporeity of light, but I do it without any absolute positiveness, as the word *perhaps* intimates, and make it at most but a very plausible consequence of the doctrine, and not a fundamental supposition, nor so much as any part of it, which was wholly comprehended in the precedent propositions. And I wonder how Mr. Hooke could imagine that, when I had asserted the theory with the greatest rigor, I should be so forgetful as afterwards to assert the fundamental supposition itself with no more than a *perhaps*. Had I intended any such hypothesis, I should somewhere have explained it. But I knew that the properties which I declared of light were in some measure capable of being explicated not only by that, but by many other mechanical hypotheses; and therefore I chose to decline them all, and speak of light in general terms, considering it abstractedly as something or other propagated every way in straight lines from luminous bodies, without determining what that thing is; whether a confused mixture of difform qualities, or modes or bodies, or of bodies themselves, or of any virtues, powers, or beings whatsoever. And for the same reason I choose to speak of colors according to the information of [our] senses, as if they were qualities of light without us. Whereas, by that hypothesis, I must have considered them rather as modes of sensation, excited in the mind by various motions, figures, or sizes of the corpuscles of the light, making various mechanical impressions on the organs of sense, as I expressed it in that place where I spoke of the corporeity of light.

"But supposing I had propounded this hypothesis, I understand not why Mr. Hooke should so much endeavor to oppose it. For certainly it has a much greater affinity with his own hypothesis than he seems to be aware of; the vibrations of ether being as useful and necessary in this as in his own. For, assuming the rays of light to be small

bodies, emitted every way from shining substances, those, when they impinge on any refracting or reflecting superficies, must as necessarily excite vibrations in the ether as stones do in water when thrown into it. And supposing these vibrations to be of several depths or thicknesses, accordingly as they are excited by the said corpuscular rays of various sizes and velocities,—of what use they will be for explicating the manner of reflection and refraction, the production of heat by the sun's beams, the emission of light from burning, putrefying, or other substances whose parts are vehemently agitated, the phenomena of thin transparent plates and bubbles and of all natural bodies, the manner of vision, and the difference of colors, as also their harmony and discord,—I shall leave to the consideration of those who may think it worth their endeavor to apply this hypothesis to the solution of phenomena.

“In the second place, I told you that Mr. Hooke's hypothesis, as to the fundamental part of it, is not against me. The fundamental supposition is that the parts of bodies, when briskly agitated, excite vibrations in the ether, which are propagated every way from those bodies in straight lines, and cause a sensation of light, by beating and dashing against the bottom of the eye, something after the manner that vibrations in the air cause a sensation of sound by beating against the organs of hearing. Now the most free and natural application of this hypothesis to the solution of phenomena I take to be this: that the agitated parts of bodies, according to their several sizes, figures, and motions, excite vibrations in the ether of various depths or bignesses, and which, being promiscuously propagated through that medium to our eyes, effect in us a sensation of light of a white color: but if by any means those of unequal bignesses be separated from one another, the largest, a sensation of red color; the least, or shortest,

of a deep violet; and the intermediate ones, of intermediate colors."

In this reply to Hooke, Newton pointed out the character of experimental science, the duties of scientific men, and the unquestionableness of experiment and observation. But it is not necessary to quote this part of the reply. I have quoted at length the parts referring to the ether and to the connected question of hypotheses as to the nature of light, and in what follows I shall continue to do this for Newton's other memoirs. The connection of the ether with the principle of gravitation will gradually appear; at present the most noticeable thing is that in 1672 Newton granted as a matter of course the existence of an ether.

"It may be," said Rosenberger,¹⁹ "that Newton, in his first memoir only adopted the emission-theory of light because it was the simplest and most convenient, and did not make a further study of other theories. But before his reply to Hooke's report, he certainly examined the undulatory hypothesis very carefully, and the supporters of this hypothesis were greatly indebted to him, for without question he was the first to show how it was possible to arrive, starting from the undulatory hypothesis, at a definition of colors and at an explanation of the dispersion of light on refraction."

IV.

At the end²⁰ of a letter written by Newton to Oldenburg on November 13, 1675,²¹ Newton wrote: "I had some thoughts of writing a further discourse about colors to be read at one of your assemblies; but find it yet against the grain to put pen to paper any more on that subject. But, however, I have one discourse by me on that subject, writ-

¹⁹ *Op. cit.*, p. 82.

²⁰ *Horsley*, Vol. IV, p. 355; *Brewster, op. cit.*, Vol. I, p. 132; *Rosenberger, op. cit.*, p. 101.

²¹ The date was not given by *Horsley*.

ten when I sent my first letters to you about colors, and of which I then gave you notice. This you may command, when you think it will be convenient, if the custom of reading weekly discourses still continue."

Newton again wrote to Oldenburg on November 30, 1675,²² that he intended to have sent the papers that week, but that upon reviewing them it came into his mind to write another "little scribble" to accompany them. This "little scribble" was his "hypothesis" to which we shall presently refer. The whole discourse was produced in manuscript on December 9, 1675, with the title of: "A Theory of Light and Colours, containing partly an Hypothesis to explain the properties of light discoursed of by me in my former papers, partly the principal phenomena of the various colours exhibited by thin plates or bubbles, esteemed to be of a more difficult consideration, yet to depend also on the said properties of light."²³ The "scribble" in particular, was entitled "An Hypothesis explaining the Properties of light discoursed of in my several Papers," and was stated by Brewster²⁴ to have been contained in a letter to Oldenburg dated January 25, 1676,—a date which seems to be a mistaken one.

In the letter²⁵ to Oldenburg which accompanied the papers forming his "discourse," Newton wrote: "I had formerly purposed never to write any hypothesis of light and colors, fearing it might be a means to engage me in

²² Brewster, *op. cit.*, Vol. I, p. 132; Rosenberger, *op. cit.*, pp. 101-102.

²³ This has been referred to in § IX of my paper on "The Principles of Mechanics with Newton from 1666 to 1679" in *The Monist* for April, 1914.

²⁴ *Op. cit.*, Vol. I, p. 390.

²⁵ Birch, *op. cit.*, Vol. III, pp. 247-248; Brewster, *op. cit.*, Vol. I, pp. 132-134; Rosenberger, *op. cit.*, pp. 101-102. This letter, and the "Hypothesis" introduced by it were read to the Royal Society, and the "Hypothesis" was printed in Birch, *op. cit.*, pp. 248-260, 261-269, and Brewster, *op. cit.*, Vol. I, pp. 390-409 (cf. Rosenberger, *op. cit.*, pp. 102-111), but not in Horsley's edition of Newton's works. The experimental part of the paper (Birch, *op. cit.*, pp. 272-305) was included without alteration in the first and second parts of the second book, and the first eight propositions of the third part of that book, of the *Opticks* of 1704. On the "Hypothesis" the conclusions from it which Newton drew, and the controversy with Hooke to which it gave rise, see also Brewster, *op. cit.*, Vol. I, pp. 136-145, 151-161.

vain disputes; but I hope a declared resolution to answer nothing that looks like a controversy, unless possibly at my own time upon some by-occasion, may defend me from that fear. And therefore, considering that such a hypothesis would much illustrate the papers I promised to send you, and having a little time this last week to spare. I have not scrupled to describe one, so far as I could on a sudden recollect my thoughts about it; not concerning myself whether it should be thought probable or improbable, so it do but render the paper I send you and others sent formerly more intelligible. You may see by the scratching and interlining it was done in haste; and I have not had time to get it transcribed, which makes me say I reserve a liberty of adding to it, and desire that you would return these and the other papers when you have done with them. I doubt there is too much to be read at one time, but you will soon see how to order that. At the end of the hypothesis you will see a paragraph to be inserted as is there directed. I should have added another or two, but I had not time, and such as it is I hope you will accept it."

In his reply to Hooke of July 11, 1672, Newton had stated that what he called the fundamental supposition in Hooke's hypothesis—namely, that the waves or vibrations of the ether could, like the rays of light, be propagated in straight lines without a very extravagant spreading and bending every way into the quiescent medium by which they are bounded—seemed impossible, and added: "I am mistaken if there be not both experiment and demonstration to the contrary." However, Newton at once suggested a modification of Hooke's hypothesis, so that it could better account for the phenomena, as we have seen towards the end of § III above.²⁶ But it is certain that Newton did not regard either this hypothesis or that of 1675 as expressing his

²⁶ Cf. *Phil. Trans.*, 1672, No. 88, p. 5088. Cf. also Brewster, *op. cit.*, Vol. I, pp. 135-136, 390.

own convictions, or as of having any more than an illustrative value. "Because I have observed," he said, "the heads of some great virtuosos to run much upon hypotheses, as if my discourses wanted a hypothesis to explain them by, and found that some, when I could not make them take my meaning when I spoke of the nature of light and colors abstractly, have readily apprehended it when I illustrated my discourse by a hypothesis; for this reason I have here thought fit to send you a description of the circumstances of this hypothesis, as much tending to the illustration of the papers I herewith send you." And he added that he would not assume either this or any other hypothesis; yet that he would, while describing this hypothesis, "sometimes, to avoid circumlocution, and to represent it more conveniently," speak of it as if he assumed it and propounded it to be believed. "This," he said, "I thought fit to express, that no man may confound this with my other discourses, or measure the certainty of one by the other, or think me obliged to answer objections against this script; for I desire to decline being involved in such troublesome, insignificant disputes."²⁷ Newton, however, confessed that he did not see how the colors of thin transparent plates could be well explained without having recourse to ethereal pulses;²⁸ and shortly afterwards remarked: "Were I to assume an hypothesis, it should be this [that mentioned in § III above], if propounded more generally so as not to determine what light is, further than that it is something or other capable of exciting vibrations in the ether."²⁹

Newton then proceeded to describe the hypothesis. "(I) It is to be supposed therein that there is an ethereal medium, much of the same constitution with air, but far rarer, subtler, and more strongly elastic. Of the existence of this

²⁷ Brewster, *op. cit.*, Vol. I, pp. 136, 391-392.

²⁸ *Ibid.*, p. 391.

²⁹ *Ibid.*

medium the motion of a pendulum in a glass exhausted of air almost as quickly as in the open air is no inconsiderable argument. But it is not to be supposed that this medium is one uniform matter, but [that it is] composed partly of the main phlegmatic body of ether, partly of other various ethereal spirits, much after the manner that air is compounded of the phlegmatic body of air intermixed with various vapors and exhalations. For the electric and magnetic effluvia and the gravitating principle seem to argue such variety. Perhaps the whole frame of nature may be nothing but various contextures of some certain ethereal spirits or vapors, condensed as it were by precipitation, much after the manner that vapors are condensed into water, or exhalations into grosser substances, though not so easily condensable; and after condensation wrought into various forms, at first by the immediate hand of the Creator, and ever since by the power of nature, which, by virtue of the command, increase and multiply, became a complete imitator of the copy set her by the Protoplast. Thus perhaps may all things be originated from ether.

"At least the electric effluvia seem to instruct us that there is something of an ethereal nature condensed in bodies. I have sometimes laid upon a table a round piece of glass about two inches broad, set in a brass ring, so that the glass might be about one-eighth or one sixth of an inch from the table and the air between them enclosed on all sides by the ring, after the manner as if I had whelmed a little sieve upon the table. And then rubbing a pretty while the glass briskly with some rough and raking stuff, till some very little fragments of very thin paper laid on the table under the glass began to be attracted and move nimbly to and fro; after I had done rubbing the glass, the papers would continue a pretty while in various motions, sometimes leaping up to the glass and resting there a while, then leaping down and resting there, then leaping up, and

perhaps down and up again, and this sometimes in lines seeming perpendicular to the table, sometimes in oblique ones; sometimes also they would leap up in one arc and down in another divers times together, without sensible resting between; sometimes skip in a bow from one part of the glass to another without touching the table, and sometimes hang by a corner and turn often about very nimbly, as if they had been carried about in the midst of a whirlwind, and be otherwise variously moved,—every paper with a divers motion. And upon sliding my finger on the upper side of the glass, though neither the glass nor the enclosed air below were moved thereby, yet would the papers as they hung under the glass receive some new motion, inclining this way or that way, accordingly as I moved my finger. Now whence all these irregular motions should spring I cannot imagine, unless from some kind of subtle matter lying condensed in the glass, and rarefied by rubbing, as water is rarefied into vapor by heat, and in that rarefaction diffused through the space round the glass to a great distance, and made to move and circulate variously, and accordingly to actuate the papers, till it returns into the glass again, and be recondensed there. And as this condensed matter by rarefaction into an ethereal wind (for by its easy penetrating and circulating through glass I esteem it ethereal) may cause these odd motions, and by condensing again may cause electrical attraction with its returning to the glass to succeed in the place of what is there continually recondensed; so may the gravitating attraction of the earth be caused by the continual condensation of some other such like ethereal spirit, not of the main body of phlegmatic ether, but of something very thinly and subtly diffused through it, perhaps of an unctuous or gummy tenacious and springy nature, and bearing much the same relation to ether which the vital aëreal spirit requisite for the conservation of flame and vital motions does

to air. For if such an ethereal spirit may be condensed in fermenting or burning bodies, or otherwise coagulating in the pores of the earth and water into some kind of humid active matter for the continual uses of nature, (adhering to the sides of those pores after the manner that vapors condense on the sides of a vessel,) the vast body of the earth, which may be everywhere to the very center in perpetual working, may continually condense so much of this spirit as to cause it from above to descend with great celerity for a supply. In this descent it may bear down with it the bodies it pervades, with force proportional to the superficies of all their parts it acts upon, nature making a circulation by the slow ascent of as much matter out of the bowels of the earth in an *aëreal* form, which for a time constitutes the atmosphere, but being continually buoyed up by the new air, exhalations, and vapors rising underneath, at length (some part of the vapors which return in rain excepted) vanishes again into the ethereal spaces, and there perhaps in time relents and is attenuated into its first principle. For nature is a perpetual circulatory worker, generating fluids out of solids, and solids out of fluids, fixed things out of volatile, and volatile out of fixed, subtle out of gross, and gross out of subtle, some things to ascend and make the upper terrestrial juices, rivers, and the atmosphere, and by consequence others to descend for a requital to the former. And as the earth, so perhaps may the sun imbibe this spirit copiously, to conserve his shining, and keep the planets from receding further from him: and they that will may also suppose that this spirit affords or carries with it thither the solary fuel and material principle of light, and that the vast ethereal spaces between us and the stars are for a sufficient repository for this food of the sun and planets. But this of the constitution of ethereal natures by the bye.

“In the second place, it is to be supposed that the ether

is a vibrating medium like air, only the vibrations far more swift and minute; those of air made by a man's ordinary voice succeeding one another at more than half a foot or a foot distance, but those of ether at a less distance than the hundred-thousandth part of an inch. And as in air the vibrations are some larger than others, but yet all equally swift, (for in a ring of bells the sound of every tone is heard at two or three miles' distance in the same order that the bells are struck,) so I suppose the ethereal vibrations differ in bigness, but not in swiftness. Now these vibrations, besides their use in reflection and refraction, may be supposed the chief means by which the parts of fermenting or putrefying substances, fluid liquors, or melted, burning, or other hot bodies, continue in motion, are shaken asunder like a ship by waves, and dissipated into vapors, exhalations, or smoke, and light loosed or excited in those bodies, and consequently by which a body becomes a burning coal, and smoke flame; and I suppose flame is nothing but the particles of smoke turned by the access of light and heat to burning coals, little and innumerable.

"Thirdly, the air can pervade the bores of small glass pipes, but yet not so easily as if they were wider, and therefore stands at a greater degree of rarity than in the free aëreal spaces, and at so much greater a degree of rarity as the pipe is smaller, as is known by the rising of water in such pipes to a much greater height than the surface of the stagnating water into which they are dipped. So I suppose ether, though it pervades the pores of crystal, glass, water, and other natural bodies, yet it stands at a greater degree of rarity in those pores than in the free ethereal spaces, and at so much a greater degree of rarity as the pores of the body are smaller. Whence it may be that spirit of wine, for instance, though a lighter body, yet having subtler parts, and consequently smaller pores than

water, is the more strongly refracting liquor. This also may be the principal cause of the cohesion of the parts of solids and fluids, of the springiness of glass and other bodies whose parts slide not one upon another in bending, and of the standing of the mercury in the Torricellian experiment, sometimes to the top of the glass, though a much greater height than twenty-nine inches. For the denser ether which surrounds these bodies must crowd and press their parts together, much after the manner that air surrounding two marbles presses them together if there be little or no air between them. Yea, and that puzzling problem *by what means the muscles are contracted and dilated to cause animal motion, may receive greater light from hence than from any other means men have hitherto been thinking on.* For if there be any power in man to condense and dilate at will the ether that pervades the muscle, that condensation or dilatation must vary the compression of the muscle made by the ambient ether, and cause it to swell or shrink, accordingly. For though common water will scarce shrink by compression and swell by relaxation, yet (so far as my observation reaches) spirit of wine and oil will; and Mr. Boyle's experiment of a tadpole shrinking very much by hard compressing the water in which it swam, is an argument that animal juices do the same: and as for their various pression by the ambient ether, it is plain that that must be more or less, accordingly as there is more or less ether within to sustain and counterpoise the pressure of that without. If both ethers were equally dense, the muscle would be at liberty as if pressed by neither: if there were no ether within, the ambient would compress it with the whole force of its spring. If the ether within were twice as much dilated as that without, so as to have but half as much springiness, the ambient would have half the force of its springiness counterpoised thereby, and exercise but the other half upon the muscle; and so in all other cases

the ambient compresses the muscle by the excess of the force of its springiness above that of the springiness of the included. To vary the compression of the muscle therefore, and so to swell and shrink it, there needs nothing but to change the consistence of the included ether; and a very little change may suffice, if the spring of ether be supposed very strong, as I take it to be many degrees stronger than that of air.

"Now for the changing the consistence of the ether, some may be ready to grant that the soul may have an immediate power over the whole ether in any part of the body, to swell or shrink it at will; but then how depends the muscular motion on the nerves? Others therefore may be more apt to think it done by some certain ethereal spirit included within the *dura mater*, which the soul may have power to contract or dilate at will in any muscle, and so cause it to flow thither through the nerves; but still there is a difficulty why this force of the soul upon it does not take off the power of springiness, whereby it should sustain more or less the force of the outward ether. A third supposition may be that the soul has a power to inspire any muscle with this spirit by impelling it thither through the nerves; but this too has its difficulties, for it requires a forcible intruding the spring of the ether in the muscles by pressure exerted from the parts of the brain; and it is hard to conceive how so great force can be exercised amidst so tender matter as the brain is; and besides, why does not this ethereal spirit, being subtle enough, and urged with so great force, go away through the *dura mater* and skins of the muscle, or at least so much of the other ether go out to make way for this which is crowded in? To take away these difficulties is a digression, but seeing the subject is a deserving one, I shall not stick to tell you how I think it may be done.

"First, then, I suppose there *is* such a spirit; that is,

that the animal spirits are neither like the liquor, vapor, or gas, or spirits of wine; but of an ethereal nature, subtle enough to pervade the animal juices as freely as the electric, or perhaps magnetic, effluvia do glass. And to know how the coats of the brain, nerves, and muscles, may become a convenient vessel to hold so subtle a spirit, you may consider how liquors and spirits are disposed to pervade, or not pervade, things on other accounts than their subtlety; water and oil pervade wood and stone, which quicksilver does not; and quicksilver, metals, which water and oil do not; water and acid spirits pervade salts, which oil and spirit of wine do not; and oil and spirit of wine pervade sulphur, which water and acid spirits do not; so some fluids, (as oil and water,) though their parts are in freedom enough to mix with one another, yet by some secret principle of *unsociableness* they keep asunder; and some that are *sociable* may become *unsociable* by adding a third thing to one of them, as water to spirit of wine by dissolving salt of tartar in it. The like *unsociableness* may be in ethereal natures, as perhaps between the ethers in the vortices of the sun and planets; and the reason why air stands rarer in the bores of small glass pipes, and ether in the pores of bodies may be, not want of subtlety, but *sociableness*; and on this ground, if the ethereal vital spirit in a man be very *sociable* to the marrow and juices, and *unsociable* to the coats of the brain, nerves, and muscles, or to any thing lodged in the pores of those coats, it may be contained thereby, notwithstanding its subtlety; especially if we suppose no great violence done to it to squeeze it out, and that it may not be altogether so subtle as the main body of ether, though subtle enough to pervade readily the animal juices, and that as any of it is spent, it is continually supplied by new spirit from the heart.

"In the next place, by knowing how this spirit may be used for animal motion, you may consider how some things

unsociable are made sociable by the mediation of a third. Water, which will not dissolve copper, will do it if the copper be melted with sulphur. *Aquafortis*, which will not pervade gold, will do it by addition of a little sal-ammoniac or spirit of salt. Lead will not mix in melting with copper; but if a little tin, or antimony, be added, they mix readily, and part again of their own accord, if the antimony be wasted by throwing saltpetre, or otherwise. And so lead melted with silver quickly pervades and liquefies the silver in a much less heat than is required to melt the silver alone; but if they be kept in the test till that little substance that reconciled them be wasted or altered, they part again of their own accord. And in like manner the ethereal animal spirit in a man may be a mediator between the common ether and the muscular juices to make them mix more freely, and so by sending a little of this spirit into any muscle, though so little as to cause no sensible tension of the muscle by its own force, yet by rendering the juices more sociable to the common external ether, it may cause that ether to pervade the muscle of its own accord in a moment more freely and more copiously than it would otherwise do, and to recede again as freely, so soon as this mediator of sociableness is retracted; whence, according to what I said above, will proceed the swelling or shrinking of the muscle, and consequently the animal motion depending thereon.

"Thus may therefore the soul, by determining this ethereal animal spirit or wind into this or that nerve, perhaps with as much ease as air is moved in open spaces, cause all the motions we see in animals; for the making which motions strong, it is not necessary that we should suppose the ether within the muscle very much condensed, or rarefied, by this means, but only that its spring is so very great that a little alteration of its density shall cause a great alteration in the pressure. And what is said of

muscular motion may be applied to the motion of the heart, only with this difference: that the spirit is not sent thither as into other muscles, but continually generated there by the fermentation of the juices with which its flesh is replenished, and as it is generated, let out by starts into the brain, through some convenient *ductus*, to perform those motions in other muscles by inspiration, which it did in the heart by its generation. For I see not why the ferment in the heart may not raise as subtle a spirit out of its juices, to cause those motions, as rubbing does out of a glass to cause electric attraction, or burning out of fuel to penetrate glass, as Mr. Boyle has shown, and calcine by corrosion metals melted therein.³⁰

"Hitherto I have been contemplating the nature of ether and ethereal substances by their effects and uses, and now I come to join therewith the consideration of light.

"In the fourth place, therefore, I suppose light is neither ether, nor its vibrating motion, but something of a different kind propagated from lucid bodies. They that will may suppose it an aggregate of various peripatetic qualities. Others may suppose it multitudes of unimaginable small and swift corpuscles of various sizes springing from shining bodies at great distances one after another, but yet without any sensible interval of time, and continually urged forward by a principle of motion, which in the beginning accelerates them, till the resistance of the ethereal medium equal the force of that principle, much after the manner that bodies let fall in water are accelerated till the resistance of the water equal the force of gravity. God, who gave animals motion beyond our understanding, is, without doubt, able to implant other principles of motion in bodies which we may understand as little. Some would readily

³⁰ Boyle's *Essays of the strange subtlety, etc. of effluvioms, etc., together with a discovery of the perviousness of glass to ponderable parts of flame.*—Note of Newton.

grant this may be a spiritual one; yet a mechanical one might be shown, did not I think it better to pass it by.³¹ But they that like not this may suppose light any other corporeal emanation, or an impulse or motion of any other medium or ethereal spirit diffused through the main body of ether, or what else they imagine proper for this purpose. To avoid dispute, and make this hypothesis general, let every man here take his fancy; only, whatever light be, I would suppose it consists of successive rays differing from one another in contingent circumstances, as bigness, force, or vigor, like as the sands on the shore, the waves of the sea, the faces of men, and all other natural things of the same kind differ, it being almost impossible for any sort of things to be found without some contingent variety. And further, I would suppose it diverse from the vibrations of the ether, because, (besides that were it those vibrations, it ought always to verge copiously in crooked lines into the dark or quiescent medium, destroying all shadows, and to comply readily with any crooked pores or passages as sounds do,) I see not how any superficies, (as the side of a glass prism on which the rays within are incident at an angle of about forty degrees,) can be totally opaque. For the vibrations beating against the refracting confine of the rarer and denser ether must needs make that pliant superficies undulate, and those undulations will stir up and propagate vibrations on the other side. And further, how light, incident on very thin skins or plates of any transparent body, should for many successive thicknesses of the plate in arithmetical progression, be alternately reflected and transmitted, as I find it is, puzzles me as much. For though the arithmetical progression of those thicknesses, which reflect and transmit the rays alternately, argues that it depends upon the number of vibrations between the two superficies of the plate whether the ray shall be reflected or trans-

³¹ Rosenberger (*op. cit.*, p. 106) remarked that this is the basis on which, later, gravitation was maintained to be a primitive force of matter.

mitted, yet I cannot see how the number should vary the case, be it greater or less, whole or broken, unless light be supposed something else than these vibrations. Something indeed I could fancy towards helping the two last difficulties, but nothing which I see not insufficient.

"Fifthly, it is to be supposed that light and ether mutually act upon one another, ether in refracting light, and light in warming ether, and that the densest ether acts most strongly. When a ray therefore moves through ether of uneven density, I suppose it most pressed, urged, or acted upon by the medium on that side towards the denser ether, and receives a continual impulse or ply from that side to recede towards the rarer, and so is accelerated if it move that way, or retarded if the contrary. On this ground, if a ray move obliquely through such an unevenly dense medium, (that is, obliquely to those imaginary superficies which run through the equally dense parts of the medium, and may be called the refracting superficies,) it must be incurved, as it is found to be by observation in water,³² whose lower parts were made gradually more salt, and so more dense than the upper. And this may be the ground of all refraction and reflection. For as the rarer air within a small glass pipe, and the denser without, are not distinguished by a mere mathematical superficies, but have air between them at the orifice of the pipe running through all intermediate degrees of density, so I suppose the refracting superficies of ether between unequally dense mediums to be not a mathematical one, but of some breadth, the ether therein at the orifices of the pores of the solid body being of all intermediate degrees of density between the rarer and denser ethereal mediums; and the refraction I conceive to proceed from the continual incurvation of the ray all the while it is passing the physical superficies. Now if the motion of the ray be supposed in this passage to

³² Mr. Hooke's *Micrographia* where he speaks of the inflection of rays.—
Note of Newton.

be increased or diminished in a certain proportion, according to the difference of the densities of the ethereal mediums, and the addition or detraction of the motion be reckoned in the perpendicular from the refracting superficies, as it ought to be, the sines of incidence and refraction will be proportional according to what Descartes has demonstrated."

After some further discussion of refraction and reflection on this hypothesis, and the causes of transparency, opacity, and color, the "scribble" concluded with an application of the hypothesis to the colors of thin plates, to the inflection of light, and to the colors of natural bodies.

After the reading of the first part of this discourse on December 9, Hooke³³ said that the main part of it was contained in his *Micrographia*, and that Newton had only carried what that work taught farther in some particulars. When this remark was communicated to Newton, he seems to have been greatly offended, and on December 21 he wrote a letter³⁴ to Oldenburg, pointing out the difference between his hypothesis and that of Hooke. Although he was "not much concerned at the liberty of Mr. Hooke's insinuation," yet he wished to "avoid the savor of having done anything unjustifiable or unhandsome" to him. He therefore separated out the part of the hypothesis that belonged to Descartes and others. This part was as follows: "That there is an ethereal medium; that light is the action of this medium; that this medium is less implicated in the parts of solid bodies, and so moves more freely in them, and transmits light more readily through them; and that after such a manner as to accelerate the rays in a certain proportion; that refraction arises from this acceleration, and has sines proportional; that light is at first uniform; that colors are some disturbance or modification of its rays

³³ Brewster, *op. cit.*, Vol. I, pp. 138-139.

³⁴ Horsley, Vol. IV, pp. 379-381; Birch, *op. cit.*, Vol. III, p. 278; Rosenberger, *op. cit.*, pp. 111-114.

by refraction or reflection; that the colors of a prism are made by means of the quiescent medium accelerating some motion of the rays on one side where red appears, and retarding it on the other side where blue appears; that there are but these two original colors or color making modifications of light, which by their various degrees, or, as Mr. Hooke calls it, dilutinga, produce all intermediate ones."

When we have put this on one side, continued Newton, we find that:

"The remainder of his hypothesis is, that he has changed Descartes's pressing or progressive motion of the medium to a vibrating one; the rotation of the globuli to the obliquation of the pulses; and the accelerating their rotation on the one hand, and retarding it on the other, by the quiescent medium, to produce colors, to the like action of the medium on the two ends of his pulses for the same end. And having thus far modified his by the Cartesian hypothesis, he has extended it farther to explicate the phenomena of thin plates; and added another explication of the colors of natural bodies fluid and solid.

"This, I think, is in short the sum of his hypothesis. And in all this, I have nothing common with him but the supposition that ether is a medium susceptible of vibrations. Of which supposition I make a very different use; he supposing it light itself; which I suppose it is not. This is as great a difference, as is between him and Descartes. But besides this, the manner of refraction and reflection, and the nature and production of colors in all cases, which take up the body of my discourse, I explain very differently from him; and even in the colors of thin transparent substances, I explain everything after a way so different from him that the experiments on which I ground my discourse destroy all he has said about them. And the two main experiments, without which the manner of the production of those colors is not to be found out, were not only un-

known to him when he wrote his *Micrographia* but even last spring, as I understood in mentioning them to him. This therefore is the sum of what is common to us: that ether may vibrate. And so if he thinks fit to use that notion of colors arising from the various bignesses of pulses, without which his hypothesis will do nothing, his will borrow as much from my answer to his objections as that I send you does from his *Micrographia*.

"But it may be that I have made use of his observations. And of some I did: as that of the inflection of rays, for which I quoted him: that of opacity arising from the interstices of the parts of bodies, which I insist not on; and that of plated bodies exhibiting colors; a phenomenon for the notice of which I thank him. But he left me to find out and make such experiments about it as might inform me of the manner of the production of those colors to ground a hypothesis on: he having given no farther insight into it than this, that the color depended on some certain thickness of the plate. Though what that thickness was at every color, he confesses in his *Micrographia* he had attempted in vain to learn. And therefore seeing I was left to measure it myself, I suppose he will allow me to make use of what I took the pains to find out. And this I hope may vindicate me from what Mr. Hooke has been pleased to charge me with."³⁵

The friendly letters which passed between Newton and Hooke shortly after this, and which were discovered by Brewster,³⁶ seem to show that both Hooke and Newton disliked controversy and held those just views on the proper attitude of one's mind to "natural philosophy" which are not very difficult to put into noble language,

³⁵ A paper entitled "Observations" accompanied this letter but was not printed. In it, according to Brewster (*op. cit.*, Vol. I, p. 139), Newton said that Hooke in his *Micrographia* had "delivered many very excellent things concerning the colors of thin plates and other natural objects," of which he had not scrupled to make use in so far as they were relevant to his purpose.

³⁶ *Op. cit.*, Vol. I, pp. 139-145.

but which are not so easy to express with such good feeling as these letters show.

After the publication of the "Hypothesis," Newton seems³⁷ to have conversed with Robert Boyle on the subject of its application of chemistry, and in 1679 wrote him a long letter which we must next examine.

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³⁷ *Ibid.*, p. 145.

SOME MEDIEVAL CONCEPTIONS OF MAGIC.*

MAGIC is attracting attention to-day. Students of folk-lore and of the history of religion cannot afford to neglect it. Anthropologists have found that it colors much of the life of primitive man, and sociologists have begun to deal with it as an important social manifestation. It occupies no small part of the written remains of Assyria and Babylonia and of the Greek papyri; in fact, its traces are evident throughout the literatures of Hellas and of Rome. The middle ages too, although they have as yet received little attention from serious modern students of magic, were a time when there was a great deal of magic and no little talk about it.

It may help us in forming a satisfactory definition and theory of magic for our own use, if we note some previous definitions of it by men who actually lived in the midst of it and believed in it. In the case of the savage we apply our term "magic" to certain of his practices, but medieval men used the very same word "magic" as we, and on the whole the extant writers of the twelfth and thirteenth centuries discuss magic more fully and directly than those even of the days of the elder Pliny and Apuleius. The present article will set forth a number of discussions of magic or significant allusions thereto in books and writers of the twelfth and thirteenth centuries. Space will not permit me to give even an idea of the vast collection of

*The author has not seen proofs of this article, owing to his absence abroad.

medieval beliefs and practices which one might classify as magic. We must limit ourselves to a few authors who define magic and omit the many who illustrate the thing without designating it by that name.

THE "POLYCRATICUS" OF JOHN OF SALISBURY.

We turn first to *Polycraticus*,¹ written about 1159 by John of Salisbury, who studied and taught in various schools of western Europe, then was long employed in official church business, and finally became bishop of Chartres in 1176. The *Polycraticus* seems designed as somewhat light reading for the cultured public, and treats such "trifles" (*nugae*) as gambling, hunting, the theater and music. John confesses that the book is little more than a patchwork of others' opinions without acknowledgment of authorities; what he probably prides himself on most is the Latin style and the numerous quotations from classical and Christian authors. In short, it is a conservative work, repeating traditional attitudes in an attractive, dilettante literary form and with such rational criticism as some study of the classics may be supposed to produce when qualified by scrupulous adherence to medieval Christian dogma.

John's discussion of magic is what one might expect from these premises. He gives, except for slight changes in arrangement and wording and the introduction of a few new items of information, a stock definition prevalent among Christian writers at least since the time of Isidore of Seville. In his *Etymologies* (VIII, 9) Isidore put together from such sources as Pliny the Elder, Jerome, and Augustine an account of the history and character of the magic arts which would fill about five ordinary pages. This passage, somewhat altered by omitting poetical quotations or inserting transitional sentences, was otherwise copied

¹ Johannes de Saresberia, "*Polycraticus sive De nugis curialium et vestigiis philosophorum*," Migne's *Patrologia Latina*, Vol. 199.

word for word by Rabanus Maurus in his *De consanguineorum nuptiis et de magorum praestigiis falsisque divinationibus tractatus*, and by Burchard of Worms and Ive of Chartres in their respective *Decreta*, while Hinemar of Rheims in his *De Divortio Lotharii et Tetbergae* copied it with more omissions.² It was also in substance retained in the *Decretum* of Gratian, whose epoch-making work in canon law appeared in the twelfth century.

This stereotyped theological definition of magic regards it not as one of many superstitions or occult arts, but as a generic term covering various superstitions and occult sciences. Very sweeping are the powers attributed to magicians. "The magicians, so-called on account of the magnitude of their evil deeds, are those who by divine permission agitate the elements, strip objects of their forms, often predict the future, disturb men's minds, despatch dreams, and slay by mere force of incantation." Magic thus includes prediction of the future as well as transformation of nature and bewitching of human beings. It subdivides into *praestigia* or illusions; *maleficia* or sorcery, literally "evil deeds"; and "various species of evil *mathematica*," a word used here in the sense of divination. Varro, "most curious of philosophers," distinguished four kinds of divination from the four elements, namely, pyromancy, aeromancy, hydromancy, and geomancy. Under these four heads, John asserts, are to be classed many sub-varieties. His list, however, includes some arts which might better be put under *praestigia* or *maleficia* than under divination. He names necromancers, enchanters, *vultivoli* (sorcerers employing human effigies of wax or

² Migne, *Patrologia Latina*, Vol. 199, cols. 406-409; 110: 1007-1110; 140: 839ff; 161: 760ff; and 125: 716-729. Moreover, Burchard continues to follow Rabanus word for word for some ten columns after the conclusion of their mutual excerpt from Isidore, while Ivo is identical with Burchard for 15 more columns. I think that I am the first to point out the identity of these five accounts. Professor Burr, in a note to his paper on "The Literature of Witchcraft" (*American Hist. Assoc. Papers*, IV, 241, 1890) has described the accounts of Rabanus and Hinemar but without explicitly noting their close resemblance, although he characterizes Rabanus's article as "mainly compiled."

clay), *pythii* or *pythonici*, *imaginarii* (who try to control spirits by use of images), *specularii* (who predict by looking into polished basins, glistening swords and mirrors), interpreters of dreams, chiromancers, *arioli*, *aruspices*, astrologers of various sorts, and so on.

We have already heard John speak of the evil deeds of the magicians. In a subsequent discussion in the second book of the *Polycraticus*,³ where he treats more fully and perhaps with more originality the various species of magic, his attitude continues to be one of unvarying, though not always very vehement, condemnation. He occasionally makes criminal charges against magic, such as exposing children to vampires or cutting them up and devouring them,⁴ and exclaims, "What shall I say of the necromancers . . . except that those deserve death who try to obtain knowledge from death?"⁵ He occasionally asserts that an occult art is irrational, as when he remarks that the error of chiromancy, "since it is not based on reason, need not be opposed with arguments,"⁶ or when he sneers with Cicero and Augustine at divination from sneezes and "inane incantations and . . . superstitious ligatures,"⁷ or when he affirms that the reputed nocturnal gatherings of witches are a delusion and that "what they suffer in spirit they most erroneously and wretchedly believe to happen in the flesh."⁸ But his chief reason for condemning the magic arts is the traditional Christian view, as old as Origen and Augustine, that they are due entirely to the influence of demons.* Scripture forbids them and God does not see fit to grant men such divining or transforming powers which he reserves for himself in signs and miracles. Indeed John's charges that magic is criminal and

³ *Polycrat.*, Liber I, Prologus, and Caps. 1-23; Migne, 199: 415-475.

⁴ *Polycrat.*, II, 17.

⁵ *Ibid.*, II, 27.

⁶ *Idem.*

⁷ *Ibid.*, II, 1.

⁸ *Ibid.*, II, 17. See too the Canon, *Ut episcopi* in Burchard's *Decreta*, Lib. X, Cap. 1.

* See my article on "The Attitude of Origen and Augustine Toward Magic," in *The Monist*, January, 1908.

irrational are but corollaries of his main thesis. These arts must be evil if demons are behind them, while their incredible pretensions can be explained only by the hypothesis of demon aid.

Although John repeats a stale definition, he indicates that the magic arts are still alive. Many varieties of ancient divination he says are now defunct;⁹ but books on oneiromancy are current.¹⁰ A priest, who taught John psalms as a boy, used to dabble in magic,¹¹ and John even gently chides Thomas à Becket, then chancellor of England and to whom he dedicates his book, for having recently consulted both an aruspex and a chiromancer.¹² At the same time John is anxious to know what "those triflers" had to say, and it must be admitted that his condemnation of some varieties of divination is a bit perfunctory and that he dwells rather fondly upon omens from classical history and upon the interpretation of dreams.

HUGO OF SAINT VICTOR.

Hugo of Saint Victor, another clerical writer of the twelfth century, gives in his *Didascalicon* a brief description of magic which differs in form but agrees substantially with John's.¹³ After the usual meagre historical account of its origin, in the course of which he twice identifies magic with *maleficia*, he says:

"Magic is not included in philosophy but is a distinct subject, false in its professions, mistress of all iniquity and malice, deceiving concerning the truth and truly doing

⁹ *Ibid.*, II, 27.

¹⁰ *Ibid.*, II, 17. Gratian seems to condemn the same book in his *Decretum*, Secunda pars, Causa XXVI, Quæst. vii. Cap. 16. Four such dream books by Daniel are to be found in the British museum, and all were printed before the close of the fifteenth century.

¹¹ *Polycrat.*, II, 28.

¹² *Ibid.*, II, 27; and see Ramsay, *Angevin Empire*, 119-120.

¹³ Printed in Migne, Vol. 176 as "Eruditionis didascalicae libri septem," but Haureau rejects the seventh book (*Les Œuvres de Hugues de Saint-Victor*, Paris, 1886). Magic is discussed in Book VI, Ch. 15 (Migne, cols. 810-812).

harm; it seduces souls from divine religion, promotes the worship of demons, engenders corruption of morals, and impels its followers' minds to every crime and abomination."

He thus makes four points against magic: It is not a part of philosophy, in other words, it is unscientific; it is hostile to true religion; it is improper, immoral, and criminal; it is false and deceptive. These four points may be reduced to two: (1) since law, religion, and learning all condemn it, it is unsocial in every respect; and (2) it is more or less untrue and unreal. At the same time it is clear that to Hugo's mind magic is a broad field more or less coordinate with those of religion and philosophy. He subdivides it, as did John of Salisbury, into *praestigia*, *maleficia*, and *mathematica*, but also into *sortilegia* and *mantice*. These last two, however, refer, like *mathematica*, to arts of divination. *Sortilegia* is divination by lots; *mathematica* covers the activities of *aruspices*, augurs, and readers of horoscopes; while under *mantice* are included geomancy, hydromancy, aeromancy, pyromancy, and necromancy.

GUNDISSALINUS.

Gundissalinus, an archdeacon of Toledo who made translations from the Arabic about the middle of the twelfth century, in a classification which he borrows from Alfarabi, makes "nigromancy according to physics" the fourth of eight subdivisions of "natural science," instead of a department of magic; but admits that he as yet has no detailed acquaintance with it.¹⁴ Yet he has given us a hint of the influence that the transmission of Arabian culture is likely to have upon the attitude toward magic in the Christian West, and in the succeeding century we note a considerable change.

¹⁴ Gundissalinus, *De divisione philosophiae* (ed. by Ludwig Baur, Münster, 1903), pp. 20 and 38.

THOMAS AQUINAS.

In the thirteenth century Thomas Aquinas, who makes a number of allusions to magic in the course of his works,¹⁵ adheres to the essential features of the theological definition, condemning magic as evil and as the work of demons.¹⁶ In the case of the three *magi* of the Gospel story, however, he explains that, while in common speech *magi* are called enchanterers (*incantatores*), in the Persian language the word designates philosophers and sages.¹⁷

Aquinas carefully distinguishes magic from miracle.¹⁸ A miracle is contrary to the order of all created nature and can be performed by God alone. Many things that seem to us marvelous or occult are not, strictly speaking, miraculous. Such are the occult virtues of physical bodies "for which a reason cannot be assigned by man."¹⁹ Such are the marvels worked in our lower world by the influence of the consellations. Even more exceeding human comprehension are the doings of demons, who, Aquinas is convinced, can not only deceive the senses and affect the human imagination but also truly transform bodies. Yet even their feats are not true miracles in violation of natural order; they simply add to the marvelous virtues of physical objects and the potent influences of the stars something of their own peculiar powers. After all, their feats can be explained, they operate by means of art; God alone is a cause absolutely hidden from every man.

As for magicians, in their feats they make use of herbs and other physical bodies; of words, usually in the form of "invocations, supplications, and adjurations"; they also

¹⁵ I have used the complete edition of Aquinas's works in 34 volumes, edited by Fretté and P. Maré, Paris, 1871-1880.

¹⁶ *De potentia*, VI, 10; *Contra Gentiles*, III, 104-106; *Quodlibet*, IV, 16. Aquinas makes considerable use of Porphyry's *Letter to Anebo*.

¹⁷ Commentary on Matthew, Cap. 2.

¹⁸ *Summa*, Prima pars, Quaest. 110, Art. 4 and Quaest. 111, Art. 3; *Contra Gentiles*, III, 101-103; *De potentia*, VI, 5; *Sententiae*, II, Dist. 7, Quaest. 2-3.

¹⁹ *Summa*, Secundae secunda, Quaest. 96, Art. 2.

employ figures and characters, sacrifices and prostrations, images and rites, carefully observed times, constellations, and other astrological considerations.²⁰ As a result hidden treasure is found, the future is revealed, closed doors open, men become invisible, inanimate bodies move and speak, apparitions of rational beings are summoned and answer questions. In such feats of magic Thomas firmly believes, but he will not admit that the magician and his materials and procedure are a sufficient cause. Demons really perform the magic. Words, figures, spells are mere signs to them; the poor magician is their dupe. It looks, Thomas admits, as if spirits came only when invoked, and as if they often came unwillingly, and sometimes performed at the magician's bidding good deeds which must be very distasteful to them as evil beings. But in all this they are simply deceiving mankind. "It is not true then that the magic arts are sciences, but rather that they are certain fallacies of the demons."²¹

Aquinas further charges that the practitioners of magic are generally criminals, perpetrating illicit deeds, adulteries, thefts, and homicides; and that at best magic does not aid man in science or virtue but in trivial matters like the discovery of stolen goods. In discussing the "motory art," which professes to acquire knowledge by fasting, prayers to God, figures, and strange words, he declares that demons cannot illuminate the intellect, although they may express in words some smattering of the sciences.²²

But in thus denying that the magic arts are sciences, Aquinas indicates that many thought them so, and that magicians believed themselves able by personal endowments, by subtle use of occult natural properties, by rites and ceremonies, and by the art of astrology, either to

²⁰ *Contra Gentiles*, III, 101-105; *De potentia*, VI, 10; *Summa*, Prima pars, Quaest. 115, Art. 5.

²¹ *Quodlibet*, IV, 16.

²² *Summa*, Secundae secunda, Quaest. 96, Art. 1.

work wonders directly and immediately or to coerce demons to work wonders for them. He thus gives us a glimpse of a different conception of magic from the old theological one.

Moreover, his own conception is scarcely that of John and Hugo. For one thing, he does not explicitly subordinate as many arts to magic as they do. Superstition is perhaps more in favor with him as a generic term than magic. He defines superstition as "a vice opposed to religion by its excess, not that it does more toward a divine cult than true religion, but that it introduces a divine cult either to what it ought not or in a way that it ought not."²³ But the chief difference between Aquinas and John and Hugo is that Aquinas justifies as scientific and moral matters which they classed under magic, and which would to-day be regarded as unscientific. He discusses the casting of lots, various forms of divination, "the occult works of nature," and the art of astrology in a manner not entirely hostile to their respective pretensions.²⁴ Thus while still holding that most arts of divination are the work of evil spirits, he believes that some kinds of divination have a natural basis and are not magic. He believes that bodies can be transformed by the occult virtues of natural things as well as by demons in magic. He recognizes much of astrology as a science, not as magic, although rejecting the extreme pretensions of astrologers. But into his interesting opinions on such points we have no time to go further here.

ALBERTUS MAGNUS.

Albertus Magnus was a contemporary of Aquinas and, like him, a great theologian and commentator upon Aris-

²³ *Ibid.*, Quaest. 92.

²⁴ *Summa*, Secundae secunda, Quaest. 95, Arts. 5-7; and the two brief treatises, *De sortibus* and *De occultis operibus, naturae*. His opinions concerning astrology are scattered through a dozen works.

totle. In his *Summa* and *Sententiae*, both theological works,²⁵ Albert, like Aquinas, more or less adheres to the traditional Christian attitude toward magic. He affirms that to employ "magic virtues" is evil and apostasy from the faith, whether one openly resorts to "invocations, conjurations, sacrifices, suffumigations, and adorations" or to some simpler and apparently innocent operation which none the less requires demon aid for its performance. Even of "mathematical virtues" (i. e., of astrological forces) one must beware, especially "in images, rings, mirrors, and characters," lest the practice of idolatry be introduced. Like Aquinas, he believes in the potency of magic. Though in one phase of magic, *praestigia* or illusions, things are made to appear to exist which have no reality, magic can also actually transform objects.

Again, like Aquinas, Albert insists that the feats of magic do not compare with miracles. They do not even happen as instantaneously, although they occur much more rapidly than the ordinary processes of nature. But except for this difference in speed they can usually be explained as the product of natural forces, and by the fact that demons are aided in their operations by the influence of the stars. To change rods into snakes, for instance, as Pharaoh's magicians did, is merely hastening the process by which worms generate in putrefying trees. Indeed, Albert is inclined to believe that the demons "produce no permanent substantial form that would not easily be produced by putrefaction." Even the magic power of fascinating human beings is, after all, only analogous to that of the sapphire to cure ulcers and of the emerald to restrain sexual passion. Thus even in his theological writings Albert attributes magic more to natural forces and to the stars, and less to demons than Aquinas did, or perhaps

²⁵ *Summa*, Secunda pars, Quaest. 30; *Sententiae*, II, Dist. 7 (Albertus Magnus, *Opera omnia*, ed. Borgnet, Paris, 1890-1899, 38 vols.)

we should say that he more closely connects the demons with forces of nature.

Moreover, a much more favorable opinion of magic may be found in Albert's biblical commentaries in his explanation of the *magi* who came to Bethlehem. Now he asserts that "the *magi* are not *malefici* as some wrongly think," and that they also differ from *mathematici*, enchanters, necromancers, *arioli*, *aruspices*, and diviners. Etymologically the *magus* is a great man (*magnus*), "who, having knowledge of all necessities and inferring from the effects of nature, sometimes predicts and produces the marvels of nature. . . . And this is laudable."²⁶ Again in his commentary on Daniel he quotes Jerome's description of the *magi* as "masters who philosophize about the universe; moreover, *magi* are more particularly called astronomers who search the future in the stars."²⁷ Thus we have magic almost identified with astrology and with natural science, and distinguished from a number of occult arts which the traditional definition identified with it.

In Albert's scientific writings we find yet a third conception of magic suggested by a number of scattered passages in which he refers to magic as if it were a distinct and definite branch of knowledge in his day, of which, though he himself does not treat, he does not seem to disapprove. In one place he refers to writings by Avicenna on magic and alchemy;²⁸ in other passages he mentions magic together with astronomy and necromancy. The "prodigious and marvelous" power of stones and of images and seals in stones, he twice assures us, cannot be really understood without a knowledge of "these three sciences."²⁹ He therefore will not discuss the subject in a treatise on minerals as fully as he might, "since those

²⁶ In *Evang. Matth.*, II, 1. It is interesting to note that to-day the *Catholic Encyclopedia* still insists concerning the three wise men, "Neither were they magicians: the good meaning of *μάγοι* though found nowhere else in the Bible is demanded by the context of the second chapter of St. Matthew."

²⁷ I, 20.

²⁸ Borgnet, *Opera*, Vol. V, p. 26.

²⁹ *Ibid.*, pp. 48 and 55.

powers cannot be proved by physical laws (*principiis physicis*), but require a knowledge of astronomy and magic and the necromantic sciences, which would be considered in other treatises. Albert's friends (*socii*), however, are curious to know the doctrine of images even if it is necromancy, and Albert does not hesitate to assure them that it is a good doctrine in any case. Yet in his theological works he declared the art of images evil "because it inclines to idolatry. . . . and. . . is employed for idle or evil ends."

Albert also counts the interpretation of dreams among "magical sciences" and speaks of the interpreters as wise men (*sapientes*).³⁰ Visions, however, which occur "when one is awake. . . but the senses diverted. . . are most employed by magicians, who indeed make a specialty of such diversions of the senses and such apparitions and of certain potions which close and stupefy the senses, and through the apparitions then made they conjecture the future."³¹ In one passage Albert remarks that whether fascination is a fact or not is for magic to determine; in another place he classifies fascination as a department of magic.³² In his treatise on the vegetable kingdom he declares that the consideration of "the divine effects" of certain plants is the especial concern of those interested in magic, and he also mentions "those who practise incantations" and necromancers as employing herbs for their marvelous properties.³³ In his treatise on animals he says that enchanter's value highly the brain, tongue, and heart of the bird hoopoe, and adds, "We shall not consider this matter at this time, for the investigation of it belongs to another science,"—presumably magic.³⁴ On the other hand, in his work on minerals, although he quotes Socrates as having said that an incantation may be performed by suspending or

³⁰ *De somno et vigilia*, III, i, 10. ³¹ *Ibid.*, III, i, 3.

³² *Ibid.*, III, i, 6; and Borgnet, *Opera*, V, 24.

³³ *De vegetabilibus*, V, ii, 3 and 6.

³⁴ *De animalibus*, XXIII, 111.

attaching objects as well as by prayers, adjurations, characters, and images, he proceeds to discuss suspensions and ligatures, especially the wonderful effects produced by wearing certain gems suspended from the neck, on the ground that they operate more naturally, and more properly belong to physical science than to magic.³⁵ In another treatise, mentioning "astronomers, augurs, magicians, interpreters of dreams and of visions, and every such diviner," he admits that almost all men of this class delight in deception and have little education, but he insists that "the defect is not in the science but in those who abuse it."³⁶

These brief allusions to magic indicate that Albert regards it as distinct from the natural sciences except "astronomy," with which he connects it rather closely, but astronomy of course for Albert includes astrology and is a science of superior bodies and stands above the sciences of inferior creation. He says that it is a fundamental principle in the science of the *magi* that all things made by art or nature are moved by celestial virtues.³⁷ But of demons in connection with magic he says nothing in his scientific writings.

In the *Speculum astronomiae* ("Mirror of Astronomy")³⁸ which also seems to be from Albert's pen, a different attitude appears. Instead of nonchalantly correlating magic, astronomy, and necromancy, as was done in the treatise on minerals, the author says nothing of magic and is concerned to distinguish between "astronomy" and necromancy, and in particular between astrological and necromantic images. His aim now is, while admitting the harmful character of necromancy as dealing with demons

³⁵ *Mineral.*, II, iii, 6. ³⁶ *De somno et vigilia*, III, ii, 5. ³⁷ *Mineral.*, II, iii, 3.

³⁸ Contained in volume X of Borgnet's edition. Franz Cumont (*Catalogus codicum astrologorum Graecorum*, V, i, 85) says that Borgnet's text of the *Speculum* is full of errors, and gives a partial new version from manuscripts. Mandonnet, "Roger Bacon et le '*Speculum astronomiae*,'" *Revue Neo-Scholastique*, Vol. XVII (1900), argues that Bacon was the author, but his argument is based in large measure on false premises.

and contrary to the Catholic faith, to defend astrology from any such imputations, and to draw up separate lists of books which are bad and necromantic and of those which are "astronomical" and of value. Some of the books now condemned as necromantic are, however, the very ones which in the treatise on minerals³⁹ Albert cited concerning the science of the *magi* and which in his theological *Summa*⁴⁰ he cited as authorities on necromancy. It therefore becomes evident that the *Speculum astronomiae* is a piece of special pleading, written in reply to a contemporary attack upon necromantic and astrological literature. In fact the author cannot restrain himself from advising that the necromantic books be preserved rather than destroyed.

Albert spoke in his scientific writings as if he might sometime write some separate treatises on magic. Two little works have come down to us which somewhat answer that description. They have been regarded as spurious, but were certainly influential, since there seem to be about as many printed editions of them alone as of all Albert's other numerous works. Their titles are *Liber aggregationis, or The Secrets of the Virtues of Herbs, Stones and Animals*, and *The Wonders of the World (De mirabilibus mundi)*.⁴¹ The former seems to be professedly a book of magic since it opens with the assertion that "magical science is not evil, since through knowledge of it evil can be avoided and good attained." The author then plunges at once into the subject of the occult virtues of herbs, stones, and animals. By these, combined with varied ceremonies and due observance of astrological considerations, such marvels can be worked as to alter the attitude of others toward oneself, reveal hidden crimes, deprive men

³⁹ II, iii, 3.

⁴⁰ II, ii, 30.

⁴¹ I have used an edition printed in Amsterdam in 1740 in which these two treatises are bound together with the *De secretis mulierum*, and with the *Physiognomy* of Michael Scot, mentioned below in note 46.

of sleep or force confidences from them when asleep, quiet barking dogs or make cows dry, free prisoners, become invisible, acquire knowledge or a good intellect, tell if one's wife be true, incite sadness or joy or love, freeze boiling water, produce an inextinguishable fire, make the sun bloody or a rainbow to appear, feel no pain under painful circumstances, drink to excess and not get drunk, conquer enemies, escape perils, overcome wild beasts, interpret all sorts of dreams, read others' thoughts, and predict the future. As in Albert's allusions to magic in his scientific writings, so here nothing is said of employing demons to produce these results, and so marvelousness rather than employment of spirits appears as the chief feature of magic.

In the *De mirabilibus mundi* "marvels" rather than "magic" are the theme, but the author has read "the books of necromancy and the books of images and magic books,"⁴² and most of the marvels which he instructs how to produce would probably be pretty generally regarded as magic by his contemporaries. Such are to make men seem headless or with the heads of animals or three heads or the face of a dog, or to make men appear in any form even as angels, or to make the entire house seem full of serpents or elephants. The author regards the human soul and its desires as the greatest force in effecting marvels, though he also recognizes the potency of occult virtues in natural objects, of heat and cold, of the influences of the stars, of procedure fitting the end sought, of suffumigations, and of demons.⁴³ Little, however, is said of demons except in connection with "the science of necromancy in which are manifested the immaterial substances which direct and assist man."⁴⁴ Despite his faith in marvels the author recognizes that "it is the wise man's task to make marvels cease" by adequate explanation of them.⁴⁵

⁴² P. 159.

⁴³ Pp. 158, 166, 170.

⁴⁴ Pp. 168-169.

⁴⁵ P. 158.

MICHAEL SCOT.

We come next to writings which emphasize more the participation of demons in magic and which illustrate in detail the relations between magic, "astronomy," and necromancy which Albertus Magnus suggested. These writings are as follows: (1) An elaborate treatise of the early thirteenth century on astrology, astronomy, and various related fields such as music and geography, dedicated to his patron the emperor Frederick II by Michael Scot,⁴⁶ who was no mere court astrologer but the introducer to medieval Christendom of many of the works of Aristotle and a translator of other writings from the Arabic; (2) A commentary of the early fourteenth century upon that brief but standard medieval astronomical treatise, *The Sphere* of Sacrobosco, by Cecco d'Ascoli,⁴⁷ who after being professor of astrology at the university of Bologna and court astrologer to the duke of Florence was condemned to the stake by the Inquisition in 1327; (3) A book of magic called *Picatrix*,⁴⁸ translated from Arabic into Spanish by order of the learned Alphonse X of Castile who reigned 1252-1284 and who is notable for his astronomical tables and mild law concerning magic.⁴⁹

Michael Scot combines traces of the patristic definition

⁴⁶ Scot's work divides into four parts; a general preface, a *Liber introductorius*, a *Liber particularis*, and a *Liber physionomiae*. Of these the first two exist in the Bodleian MS. 266 (saec. XV, 218 fols., long double columns, text greatly abbreviated, and in many different hands illustrated); and at Munich, Staatsbibliothek, Cod. Lat. 10268 (saec. XIV, 146 fols.). The *Liber particularis* is found only at the Bodleian in MS. Canon Misc. 555, where it occupies fols. 1-59, and the *Liber physionomiae*, fols. 59-88. The last, however, has been separately printed. (See note 41.)

⁴⁷ I used two editions of 1499 and 1518 at the British Museum.

⁴⁸ The work is extant in Latin translations in MSS. XX, 20, and XX, 21 of the National Library at Florence. Both manuscripts have the same colophon, dated in 1536 and the pontificate of Paul III, but their contents are not always identical although they roughly correspond. Symphorien Champier, writing in 1514, refers to *Picatrix* in his edition of the *Conciliator* of Peter of Abano.

⁴⁹ *Los Codigos Españoles concordados y anotados: Código de las siete partidas*, 2d ed., Madrid, 1872, Vol. IV. La setena partida: Título XXIII: Ley 1-3. Divination of the future by the stars is sanctioned in the case of persons properly trained in astronomy, although other varieties of divination

of magic with the attitude of an astrologer and with citations from Arabian sources and from books of necromancy and of the notory art. Thus he condemns magic and necromancy, but lists as "arts which are in a certain measure palliated under the name of astronomy," geomancy, hydromancy, aeromancy, pyromancy, nigromancy, augury, physiognomy, praestigiomancy, the notory art, lot-casting, and alchemy.⁵⁰ He represents magicians as acquainted with secrets of nature and as employing herbs as well as characters and incantations.⁵¹ He states that alchemists, nigromancers, and workers in the notory art owe more to astrology than they admit,⁵² and informs us that by astronomical images very wise demons can be conjured to give responses.⁵³ He also mentions "the virtues who rule the circles of the planets," "the legion of damned spirits" who exist in the winds,⁵⁴ and the evil spirits in the moon who are wise in all sciences and may be invoked by conjurations.⁵⁵ He states that since demons are by nature fond of blood, and especially of human blood, nigromancers or magicians in performing their experiments often mix water with real blood or use wine that has been been exorcised to make it bloody, "and they sacrifice with flesh of a living human being, such as a bit of their own flesh or of a corpse, and not with the flesh of brutes, knowing that the consecration of a spirit in a ring or a bottle cannot be achieved except by the performance of many sacrifices."⁵⁶ Scot also lists the names by which spirits may be invoked.⁵⁷ Thus he shows more interest in necromancy than is consistent with his formal condemnation of it and magic.

are forbidden; and while those who conjure evil spirits or who make waxen, metallic or other images with the aim to harm their fellows are to be punished by death, those who employ incantations with good intentions and good results are pronounced deserving of reward rather than penalty.

⁵⁰ Bodleian MS, 266, fol. 22.

⁵¹ *Ibid.*, fol. 23.

⁵² *Ibid.*, fols. 2 and 20.

⁵³ *Ibid.*, fol. 21.

⁵⁴ *Ibid.*, fols. 28-29.

⁵⁵ Canon misc., fol. 17.

⁵⁶ Bodl. MS. 266, fol. 22.

⁵⁷ *Ibid.*, fol. 172.

CECCO D'ASCOLI.

The attitude of Cecco d'Ascoli is very similar.⁵⁸ He gives a classification of the magic arts almost identical with that by Hugo of St. Victor, but states that he derives it from the *Liber de vinculo spiritus* of Hipparchus. He of course does not regard astrology as a part of magic, and declares that while one can learn something of the future through magic, the science of the stars is "a more excellent way." Magic is, he says, "emphatically censured by holy mother church."⁵⁹ This fact, however, does not restrain him from frequently citing magic books such as Apollonius's *Liber artis magicae*, nor from telling his students—his commentary is evidently a set of classroom lectures—all the necromancy that he happens to know. Thus when Sacrobosco describes the *coluri*, or circles whose function is to distinguish the solstice and equinox, Cecco comments that Hipparchus in the *Liber de hierarchiis spirituum* tells of incubi and succubi who inhabit these circles and by whose virtue in a greater conjunction divine men are born such as Merlin was and Antichrist will be.⁶⁰ When Sacrobosco mentions the four cardinal points, Cecco is reminded of Hipparchus's statement in the *Liber de ordine intelligentiarum* that certain princes of the demons "hold the four parts beneath the sky. For expelled from heaven they occupy the air and the four elements."⁶¹ When Sacrobosco speaks of the zenith or poles in a purely astronomical way, Cecco quotes Hipparchus again as saying, "O wonderful zenith and godlike nature, etc.," after the manner of an invocation, or Solomon in the *Liber de umbris idearum* as exclaiming, "O arctic manes, O antarctics

⁵⁸ The following references to Cecco's Commentary apply to the edition of 1518 in which it occupies the first 23 leaves of a collection of commentaries upon Sacrobosco and of other astronomical treatises.

⁵⁹ Fol. 3: *a sancta matre ecclesia vituperabiliter improbata.*

⁶⁰ Fol. 14.

⁶¹ Fol. 15.

propelled by divinity."⁶² When Sacrobosco treats of climates, Cecco remarks that the word may be understood in two ways, astronomically or necromantically. It is in the latter sense that Zoroaster, "the first inventor of the magic art," uses the word when he says, "For those climates are to be marveled at, which with flesh of corpses and human blood give responses the more trustworthily." "By this," continues Cecco, "you should understand those four spirits of great virtue who stand in *cruciatibus locis*, that is, in east, west, north and south, whose names are these, Oriens, Amaymon, Paymon and Egim, spirits who are of the major hierarchy and who have under them twenty-five legions of spirits apiece. Therefore because of their noble nature these seek sacrifice from human blood and from the flesh likewise of a dead man or cat. But this Zoroastrian art cannot be carried on without great peril, fastings, prayers, and all things which are contrary to our faith."⁶³

Such a belated and somewhat perfunctory warning that these things are contrary to the Christian religion is characteristic of Cecco. Elsewhere he calls these spirits demons and diabolical⁶⁴ and states with Augustine that "spirits who are outside the order of grace" cannot truly transmute bodies nor raise the dead, nor do any marvels and feats of magic except those which can be accounted for by the occult virtues of nature.⁶⁵ He also asserts that a "Floron," mentioned by Salomon in the *Liber de umbris idearum*, was of the hierarchy of cherubim and was confined in a mirror by a major invocation, and that this Floron knew many secrets of nature and deceived King Manfred and others by ambiguous oracles. "So beware of these demons because their ultimate intention is to deceive Christians to the discredit of our Lord Jesus Christ."⁶⁶

⁶² Fols. 20 and 17.

⁶³ Fol. 16.

⁶⁴ Fol. 21.

⁶⁵ Fol. 17.

⁶⁶ Fols. 17 and 22.

Yet on the next page we find Cecco saying that if any one wishes to make an image in order to obtain responses from a spirit, he ought to observe the instructions which follow; while five pages later he cites a response of this same Floron as to the time when demons are least liable to deceive one and when as a consequence it is best to consult them. In short Cecco's work is less a commentary on Sacrobosco's *Sphere* than a manual of astrological necromancy.

PICATRIX.

Picatrix is a confused compilation of extracts from occult writings and a hodgepodge of innumerable magical and astrological recipes. The author states that he "has compiled this book," that he intends to set forth "in simple language" what past sages have concealed in cryptic words, and that he has spent some six years in reading 224 books by "ancient sages."⁶⁷ Whenever modern compilers of the notions of folklore and the magical customs of aborigines shall have exhausted their resources, a rich mine will still await them in this book of magic.

For *Picatrix* is openly and professedly a book of magic. At the close of the first of its four books we are told that its contents are "the roots of the magic art" and that "without them one cannot become perfect in such arts."⁶⁸ Throughout all four books "magic works," "magic effects," "magical sciences," and "the operator of magic" are mentioned, and books of magic by Abrarem (Abraham?), Geber, and Plato are cited.⁶⁹ It is true that the term necromancy is also employed frequently and a chapter devoted to its definition,⁷⁰ and that astrological images and

⁶⁷ MS. XX, 20, fols. 1 *verso* and 53 *recto*.

⁶⁸ *Ibid.*, 15v.

⁶⁹ *Ibid.*, 7v., 44r., 44v., 22v., 23r., 28r., 40r., 50r., 51r., 99r.; MS. XX, 21, fols. 78r. and 79v.

⁷⁰ Liber I, Cap. 2. This chapter is much briefer in MS. XX, 21 than in MS. XX, 20.

invocations of demons are the subjects most discussed. But it is said on the supposed authority of Aristotle that the first man to work with such images and to whom spirits appeared was Caraphrebin, the inventor of the magic art.⁷¹ It is also affirmed that the science of the stars is the root of magic, that the forms of planets or astronomical images "have power and marvelous effects in magic operations," while after announcing his intention of listing "the secrets of the ancient sages in the magic art" the first thing that our author divulges is that the influence of Saturn exceeds the influence of the moon.⁷²

On the whole then, while magic is not defined at length in *Picatrix*, it seems justifiable to apply it as a general term covering the contents of the book and to regard astronomical images and invocations of demons as two of magic's leading characteristics. *Picatrix* regards magic as a science, as a superior branch of learning, to excel in which many other studies must first be mastered; and he believes that the greatest philosophers of antiquity, like Plato and Aristotle, have written works of magic.

Much use of natural objects is made in the various recipes of *Picatrix*. Here is one brief instance: Adam the prophet says that if you take 14 grains of the fruit of the laurel tree, dry them well and pulverize them and put the powder in a very clean dish in vinegar, and beat it with a twig from a fig tree, you can make any one you wish possessed of demons by giving him this powder to drink.⁷³ One chapter is especially devoted to "the virtues of certain substances produced from their own peculiar natures," and the author further explains that "in this section we shall state the marvelous properties of simple things as well of trees as of animals and of minerals."⁷⁴ In actual procedure, however, the use of several things combined is

⁷¹ MS. XX, 20; fol. 55v. ⁷² *Ibid.*, 32v. and 28r. ⁷³ MS. XX, 21, fol. 79v.

⁷⁴ Lib. IV, Cap. 8. MS. XX, 20, fol. 108v; MS. XX, 21, fol. 86r.

usually recommended, as a suffumigation of 14 dead bats and 24 mice, to give a comparatively simple example.⁷⁵

On the supposed authority of Aristotle in a book written to Alexander, detailed instructions are given how to make four "stones" of great virtue and of elaborate composition by procedure more or less alchemistic.⁷⁶ Indeed, there are listed all sorts of "confections," compounds, and messes, either, to burn or sacrifice or eat or drink or smell of or anoint oneself with, in order to bring various wonders to pass. The ingredients employed include different oils and drugs, butter, honey, wine, sugar, incense, aloes, pepper, mandragora, twigs, branches, adamant, lead, sulphur, gold, the brains of a hare, the blood of a wolf, the urine of an ass, the filth of a leopard, and various portions of such animals as apes, cats, bears and pigs.

Hermes is quoted as saying that there are many marvels for necromancy in the human body,⁷⁷ various parts of which are often employed. Thus in making a magic mirror one is bidden to employ a suffumigation of seven products of the human body, namely, tears, blood, ear-wax, spittle, *sperma*, *stercus*, *urina*.⁷⁸ Vile and obscene substances seem in great demand for purposes of magic throughout the book. Besides ingredients, all sorts of receptacles and material paraphernalia are listed: vessels, jars, vases, braziers, crosses, candles, crowns, etc. *Picatrix*, like the *De Mirabilibus*, considers heat an important force in magic and mentions both elemental and natural heat, the former referring to the use of the element fire in sacrifice, suffumigation and the preparation of magic compounds, the latter designating the heat of digestion when recipes must be eaten to take effect.⁷⁹

Much is said of the magician himself as well as of the materials which he employs. He should have faith in his

⁷⁵ MS. XX, 20, fol. 70r.

⁷⁶ Lib. III, Cap. 10. MS. XX, 20, fol. 73v. MS. XX, 21, fol. 53r.

⁷⁷ MS. XX, 21, fol. 60v.

⁷⁸ *Ibid.*, 22v.

⁷⁹ Lib. I, Cap. 2.

procedure, put himself into an expectant and receptive mood, be diligent and solicitous.⁸⁰ Often chastity is requisite, sometimes fasting or dieting, sometimes the wearing of certain garments.⁸¹ He must have studied a long list of other sciences before he can attempt necromancy, but then to succeed in magic he must drop all other studies and devote himself to it exclusively.⁸² A little knowledge of necromancy is a dangerous thing, and the ignorant meddler therein is liable to be violently slain by indignant demons.⁸³ Much depends also upon the magician's personality and natural fitness. No one can succeed in the science of images unless his own nature is inclined thereto by the stars. Some men are more subtle and spiritual, less gross and corporeal than others, and hence more successful in magic.⁸⁴ The ancients, when they wished to employ a boy in magic, used to test his fitness by fire as well as to make sure that he was physically sound.⁸⁵

It has already been implied that great stress is laid upon procedure. Images of persons or things concerned are extensively employed. Thus to catch fish one makes an image of a fish, and to bewitch a girl one makes a waxen image of her and dresses it in clothes like hers. In both cases, however, there is additional ceremony to be observed. The head of a fish should be fashioned first; the image is to be poised on a slender rod of silver, and this is to stand erect in a vessel which is to be filled with water, sealed tightly with wax, and dropped to the bottom of the stream where one is to fish.⁸⁶ In the bewitching of the girl, which is told as an actual occurrence, the object was to make her come to a certain man. Hence another image was made of him out of a pulverized stone mixed with gum, and the two images were placed facing each other in a vase where seven twigs of certain trees had been ar-

⁸⁰ I, 4.⁸¹ II, 12; III, 5 and 7 and 12, etc.⁸² IV, 5.⁸³ MS. XX, 20, fol. 12r. and MS. XX, 21, fol. 75v.⁸⁴ Lib. III, 6 and IV, 1 ⁸⁵ MS. XX, 21, fol. 47v. ⁸⁶ MS. XX, 20, fol. 10.

ranged crosswise. The vase was then buried under the hearth where there was a moderate fire and a piece of ice. When the ice had melted the vase was unearthed and the girl was immediately seen approaching the house. In the reverse process to free her from the spell a candle was lit on the hearth, the two images were taken out and rudely torn apart and an incantation uttered.⁸⁷

To make a spring that is going dry flow more freely a small and comely virgin should walk up and down beating a drum for three hours, and then another small and good-looking girl should join in with a tambourine for six hours more. To ward off hail storms a company of people should go out in the fields, half of them tossing handfuls of silk toward the sky and the other half clapping their hands and shouting as rustics do to frighten away birds.⁸⁸ Tying seven knots and saying an incantation over each is another specimen of the ceremonial in *Picatrix*.

Ritual also plays an important part in the invocation of spirits. If one wishes to invoke the spirit called "Complete Nature" he must enter a spick and span room while the moon is in the first degree of Aries. Various receptacles filled with different foods and combustibles must be arranged in a certain way on a table. Then he must stand facing the east and invoke the spirit by its four names seven times and repeat a prescribed form of prayer for increase of knowledge and of moral strength.⁸⁹ To draw down the virtue and power of the moon one crowns oneself in the favorable astrological hour and goes to a green spot beside a stream. There he beheads with a bone—under no circumstances employing iron—a cock with a divided crest. He stands between two braziers filled with live coals on which he casts grains of incense gradually until smoke arises; then, looking toward the moon, he should say, "O

⁸⁷ *Ibid.*, fol. 52.

⁸⁸ *Ibid.*, 103v.; MS. XX, 21, fols. 81v., 82r.

⁸⁹ III, 6. MS. XX, 20, fols. 54-55; MS. XX, fols. 21, 32-34.

moon, luminous and honored and beautiful, thou who shatterest darkness by thy light, rising in the east and filling the whole horizon with thy light and beauty, I come to thee humbly asking a boon." Having stated his wish, he withdraws ten paces, facing the moon the while and repeating the above formula. Then more incense is burned and a sacrifice performed and characters inscribed on a leaf with the ashes of the sacrifice and a bit of saffron. This leaf is then burned and as its smoke rises the form of a well-dressed man will appear, who will answer the petition.⁹⁰

Throughout *Picatrix* planets and spirits are closely associated. Many instructions are given how to pray to each of the planets and to work magic by their aid, just as if they were demons. It is hard to say whether the spirits are more thought of as forces in nature or the stars as gods. A necromancer who does not know astronomy is helpless, and each planet has a list of personal names associated not only with itself but with its every part and position.⁹¹ Lists are also given of the boons which one may ask from each planet, and of the stones, metals, animals, trees, colors, tinctures, odors, places, suffumigations, and sacrifices appropriate to each planet and sign of the zodiac, in order that one may use the proper materials, eat the right food, and wear the right clothes when petitioning any one of them.⁹² Let us remember, too, that the natural qualifications of the magician depend upon his horoscope.

Finally *Picatrix* devotes much space to astronomical images,⁹³ which, engraved preferably upon gems in accordance with the aspect of the sky at some instant when the constellations are especially favorable, are supposed to receive the celestial influences at their maximum and store them up for future use. That they receive "the force of

⁹⁰ IV, 2. MS. XX, 21, fol. 68v.

⁹¹ III, 9. MS. XX, 20, fol. 71r. MS. XX, 21, fol. 50r.

⁹² II, 5 and 10; III, 1 and 2.

⁹³ Liber II, *passim*: also I, 4-5 and IV, 9.

the planets" and do marvelous works, such as the invocation of demons, is, *Picatrix* believes, "proved by nature and by experiment." He lists them for 48 figures made from the fixed stars, for the 28 mansions of the moon, for the signs of the zodiac and the planets. As an example may be given one of the images for Saturn: "A man erect on a dragon holding a sickle in his right hand and a spear in his left hand, and clad in black clothing and a panther skin." This image "has power and marvelous effects in magic works."⁹⁴ Characters made up of lines and geometrical figures are also derived from the constellations and are supposed to possess marvelous efficacy.

Some of the results attributed to images and characters are to drive away mice, free captives, throw an army into a town, render buildings safe and stable or impede their erection, acquire wealth for oneself or one's friends, make two persons fall in love, make men loyal to their lord, make the king angry with some one, cure a scorpion's sting, walk on water, assume any animal form, cause rain in dry weather and prevent rain in wet weather, make the stars fall or sun and moon appear to be divided into many parts, ascend into the air and take the form of a falling star, speak with the dead, destroy a city or enemy, traverse great distances in the twinkling of an eye. Similar are the aims of incantations, invocations, and recipes, as has already been indicated in several cases. Ten "confections" are listed that stop evil tongues; eight, that generate discord and enmity; six, that taken in food cure impotency; seven, that induce a sleep like unto death; ten, that induce a sleep from which one never wakes.⁹⁵ Others prevent dogs from barking at you, produce green tarantulas or red serpents, remove bothersome frogs from pools, cause water to burn and appear red, enable one to see small objects a

⁹⁴ II, 10. MS. XX, 20, fol. 32v. MS. XX, 21, fol. 14v.

⁹⁵ III, 11. MS. XX, 20, fol. 78v. MS. XX, 21, fol. 58v.

long way off, make the winds and tempests obey you, deprive of memory or sense or speech or sight or hearing, and so on through a long gamut. We note that the aims are now good, now evil, that they are infinitely varied, and that they are very much like the aims of the two works attributed to Albertus Magnus where so little use of demons was made.

THABIT BEN CORRA.

Astronomical images are again associated with magic in a little treatise of fourteen pages by Thabit ben Corra ben Zahrun el Harrani, whom Albertus Magnus, Peter of Abano, Cecco d'Ascoli, and *Picatrix* all cite as an authority on images,⁹⁶ and whom Roger Bacon styles "supreme philosopher among all Christians."⁹⁷ Hence, although he was born in Mesopotamia in 836 and lived for the most part at Bagdad until his death in 901, we may regard his conceptions as still influential in thirteenth century Europe. His treatise concludes: "And this is what the highest God wishes to show to his servants concerning magic, that his name may be honored and praised and ever exalted through the ages." In the printed edition of Frankfort, 1559, it is entitled *De tribus imaginibus magicis*.⁹⁸ Yet no mention is made of demons, and we are told that the material, be it lead or bronze or gold or wax, from which the image is made is unimportant, and that all depends upon the astronomical conditions at the time of construction. However, some sort of non-astronomical ceremony is usually added, such as burying the image, wrapping it in a clean cloth, writing upon it the names of the persons concerned and the end sought, and "naming the image by a

⁹⁶ *Mineral.*, II, iii, 3; *Spec. astron.*, Cap. XI; *Conciliator*, Diff. X, fol. 16, GH; *Sphaera*, Cap. 3.

⁹⁷ Bridges, I, 394.

⁹⁸ A treatise entitled *Liber prestigiorum Thebidis (Elbidis) secundum Ptolemeum et Hermetem per Adhelardum bathoniensem translatus*, which occupies fols. 70-74 in MS. 328 at Lyons, is possibly the same work.

famous name"—which perhaps has reference to spirits. The objects sought are similar to those in *Picatrix*.

ROGER BACON.

From the picture of magic from the inside and by one favorably disposed toward it which *Picatrix* affords we turn to a last description by one of the most critical and scientific minds of the thirteenth century, Roger Bacon. He mentions magic a number of times in his *Opus maius* and *Opus tertium*, and also wrote a short treatise entitled, "On the Secret Works of Art and Nature and the Nullity of Magic."⁹⁹ He uses magic as a generic term and adopts the same fivefold division of it as Hugo and Cecco.¹⁰⁰ Toward it his point of view is that of the Christian man of science rather than of the theologian. He does not sound a religious retreat from magic but a scientific attack upon it. What impresses him most is not its irreligious nor criminal character, although he calls the magicians *maledicti*¹⁰¹ and is careful to admit the possibility of demons participating in magic, but that magic is fraudulent and futile. He couples the words "false and magical,"¹⁰² speaks of the "figments of the magicians,"¹⁰³ and associates magic, not like Albert with necromancy and astronomy, but with necromancy and deception.¹⁰⁴ For him magicians are neither *magni* nor philosophers and astronomers; in half a dozen passages he classes them with old wives and witches.¹⁰⁵

He represents magic as using sleight-of-hand, ventriloquism, subtle mechanism, darkness, and confederates to simulate results which it is unable to perform.¹⁰⁶ Or by

⁹⁹ Roger Bacon, *Opus maius*, ed. J. H. Bridges, Oxford, 1897, 2 vols. and a third published in 1900. Roger Bacon, *Opera inedita* (including the *Opus tertium* and *De secretis*), ed. J. S. Brewer in Vol. XV of *Rerum Britannicarum medii aevi scriptores*, London, 1859.

¹⁰⁰ Bridges, I, 240.

¹⁰¹ *Ibid.*, 395 and 399.

¹⁰² Brewer, pp. 47, 95.

¹⁰³ *Ibid.*, 532.

¹⁰⁴ Bridges, I, 262.

¹⁰⁵ *Ibid.*, 395-6, 398, 399; Brewer, 46-7, 95, 98.

¹⁰⁶ Brewer, 523.

use of natural objects it idly flatters itself that it coerces spirits who in reality respond only with evil intent and as God permits. Thus the *mathematici* in particular not only wrongly ascribe fatal necessity to the stars and "invoke demons by conjurations and sacrifices to supplement the influence of the constellations," but they mar their observations of the sky by circles and figures and characters of the vainest sort and by very stupid incantations and senseless prayers in which they put their trust," and they often resort to "confederates, darkness, deceptive mechanisms, sleight-of-hand—methods in which they know there is allusion— and by those methods in which there is no virtue from the sky they perform many feats that seem marvels to the stupid."¹⁰⁷ As for incantations, "the human voice has not the power that magicians imagine"; and when magic words are spoken, "either the magician accomplishes nothing or the devil is the real author of the work."¹⁰⁸ Bacon dismisses the views of magicians concerning fascinations and transformations as "worthless," "stupid," and so on.¹⁰⁹

But it is clear from Bacon's frequent references to magic that it is a delusion still very much alive. Indeed he expressly asserts not only that magic was prevalent in antiquity, though opposed by philosophy, and that magicians resisted the early church,¹¹⁰ but also that "every nation is full" of the superstitions sown by demons, witches, and magicians.¹¹¹ "Books of the magicians," falsely attributed to Solomon and ancient philosophers and which "assume a grand-sounding style," are in circulation but are really "new inventions" and "ought all to be prohibited by law, since they abound in so many lies that one cannot distinguish the true from the false."¹¹²

¹⁰⁷ Bridges, I, 241.

¹⁰⁸ Brewer, 98; Bridges, I, 399.

¹¹¹ Bridges, I, 395.

¹⁰⁹ Brewer, 531, and 96.

¹¹⁰ Brewer, 29; Bridges, I, 29 and 241.

¹¹² Brewer, 526 and 531.

Indeed, Bacon seems to think that magic has taken such a hold upon men that it can be uprooted only by scientific exposition of its tricks and by scientific achievement of even greater marvels than it professes to perform. Perhaps he realizes that religious censure or rationalistic argument is not enough to turn men from these alluring arts, but that science must show unto them yet a more excellent way, and afford scope for that laudable curiosity, that inventive and exploring instinct which magic pretends to gratify. He asserts concerning experimental science: "It alone instructs how to consider all the follies of the magicians, not to confirm them, but to shun them, just as logic deals with sophistry."¹¹³ Bacon also contends that the wonders of nature and the possibilities of applied science far outshine the feats of magicians.¹¹⁴ Science, in short, not merely attacks magic's front; it can turn its flank and cut it off from its base of supplies.

But Bacon's science is sometimes occult science. Some of his "secret works of art and nature" would be classified as magic by many of our authors. He really goes about as far as Albertus Magnus in credulous acceptance of superstition and marvels, but does not apply the term magic to what Albert admits is magic. Bacon has no intention of classifying as magic all astrology, or all use of incantations, characters, and fascination. He holds that there are two meanings of the word *mathematica*, which may be used to denote either a branch of magic or a part of philosophy, although some theologians ignorantly condemn both alike.¹¹⁵

Bacon also complains that the mass of students and professors and many authorities in theology and canon law call all images magical indiscriminately, and that as a consequence "scarcely any one has dared to speak in public"

¹¹³ Bridges, II, 172.

¹¹⁴ Brewer, 532-537.

¹¹⁵ Bridges, I, 239 and 247; Brewer, 27.

of the marvels that can be wrought by use of astronomical images, "for such men are immediately called magicians although really they are very wise."¹¹⁶ Similarly, although haphazard fascination is magic, Bacon holds that just as certain bodily diseases are contagious, so if some malignant soul thinks powerfully of infecting another and desires this ardently and is full of faith in its own power to injure, "there is no doubt that nature will obey thought, as Avicenna shows, . . . and this much is not magic."¹¹⁷

Bacon also does not doubt that the human voice "has great virtue, though not that power which magicians imagine"; and he declares that words are the most appropriate instrument of the soul, as is shown by the fact that almost every miracle from the beginning of the world has been performed by the use of words:¹¹⁸ "For where the attention, desire, and virtue of the rational soul, which is worthier than the stars, concur with the power of the sky, either a word or some other work must be produced of marvelous power in altering the things of this world, so that not natural objects only but souls will be inclined as the wise operator wishes." Incantations of this sort, "brought forth by the exertion of the rational soul and receiving the virtue of the sky as they are uttered" are philosophical, not magical.¹¹⁹

Bacon wants books of magic destroyed, but he states that many writings are reputed to be magic which are nothing of the kind but contain sound learning.¹²⁰ He accuses magicians not merely of ascribing falsely various "enormities" to Solomon, but also of interpreting incorrectly and making evil use of "enigmatical writings" which he believes Solomon really did write.¹²¹ After all this we are not surprised at his complaint that men are confusing

¹¹⁶ Bridges, I, 394.¹¹⁷ *Ibid.*, 398.¹¹⁸ Brewer, 96 and 528-531; Bridges, I, 398.¹¹⁹ Bridges, I, 395.¹²⁰ Brewer, 532.¹²¹ Bridges, I, 392.

science and philosophy with magic; and that contemporary theologians, Gratian, and "many saints" "have condemned many useful and splendid sciences along with magic."¹²² Indeed we strongly suspect that Bacon has made up for himself such a definition of magic that he can condemn it and not be accused of it.

It would be unjustifiable to attempt a final definition of magic on the basis of data from so brief and late a period in its history as the one here considered. But our material seems to offer valuable suggestions toward such a definition. Varying in some respects as are the descriptions of magic which have been here summarized, they seem to be but different views of the same thing. Magic appears on the whole as a great primary division of human thought and activity. Other subjects are subordinated to it, not it to any other field. Where some of our writers draw a line between magic and astrology or between certain other forms of divination and magic, it is apt to be because they approve of the one and feel that they ought to disapprove of the other. Magic appears as a human art or group of arts employing varied materials in varied rites, often fantastic, to work a great variety of marvelous results, which offer man a release from his physical, social, and intellectual limitations, not by the imaginative and sentimental methods of music, melodrama, and romance, nor by religion's spiritual experience, but by operations supposed to be efficacious here in the world of external reality. Some writers lay great stress on resort to spirits in magic, some upon the influences of the heavens, some on both these, and some almost identify the two; but, except as theological dogma insists upon the demoniacal character of magic, it cannot be said that spirits or stars are thought of as always necessary in magic. The *sine qua non* seems to be a human operator, materials, rites, and the aiming

¹²² *Ibid.*, 396.

at a result that borders on the impossible, either in itself or because of the means employed.

In our authors it is difficult to account for the occult properties attributed to things and acts, and to discern any one underlying principle, such as sympathy, symbolism, imitation, contagion, resemblance, or association, guiding the selection of materials and rites for magic. This is either because there never was such a principle, or because we deal with a late stage in the development of magic, when the superstitions of different peoples have coalesced, when its peculiar customs have become confused with those of science and religion, after its primitive methods have been artificially over-elaborated, and after many usages have been gradually corrupted and their original meaning forgotten. Whether magic is good or evil, true or false, is with our authors a matter of opinion, in which the majority hold it to be true but evil. Few, however, can avoid a wholesome feeling that there is something false about it somewhere. Finally, our material shows conclusively that the history of magic is bound up with the history of science as well as with folk-lore, primitive culture, and the history of religion.

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CRITICISMS AND DISCUSSIONS.

THE PURELY ORDINAL CONCEPTIONS OF MATHEMATICS AND THEIR SIGNIFICANCE FOR MATHEMATICAL PHYSICS.

As a consequence of the work of Georg Cantor and Bertrand Russell,¹ it has long been recognized that many of the conceptions and theorems familiar to us in the theory of what are called "linear point-aggregates" can be generalized to analogous conceptions and theorems in the theory of simply ordered aggregates. Thus in the theory last mentioned we have the conceptions of Limes, of compactness (*Ueberalldichtsein*), and the continuity of a simply ordered aggregate, and, as I have shown in 1905, that of the continuity of a function and certain theorems on continuous functions. More recently, I have tried to generalize certain fundamental theorems of the theory of point-aggregates.

It should be remarked that the theory of point-aggregates is concerned with the exact investigation of that substratum, so to speak, on which the various parts of mathematics—analysis, geometry, mathematical physics—are built. The "real" numbers of analysis form a "simply ordered aggregate," and we may picture it under the form of a continuous straight line; the "ordinary complex" numbers of analysis form a continuum of two dimensions; and so on.

The purpose of such generalizations of the theorems of ordinary analysis into theorems of the purely ordinal theory of functions—in which the aggregates considered are not assumed to be aggregates of numbers—is what I think is the prime purpose of all generalizations: namely, to extract from often irrelevant detail surrounding a theorem the necessary and sufficient conditions of its validity. Thus in forming an ordinal theory of functions our prime motive is to discover how far the particular properties of the

¹ Cf. *The Monist* for Jan. 1912, Vol. XXII, pp. 149-158.

real (or complex, when we deal with multiply ordered series) number system are essential to the theory of functions.

Thus a theorem known by the names of Heine and Borel has been shown by O. Veblen in 1904 to be equivalent to a process which was often used by Weierstrass (it had been used by Bernhard Bolzano in 1817, and by others), when we deal with the aggregate of real numbers, and confine our attention to ordinary mathematics. But the aspect of things is changed when we proceed to the analogous, but far more general, theory of simply ordered aggregates in general. Here, as I showed in a paper published in 1910,² the Heine-Borel process has a distinct methodological advantage over the Bolzano-Weierstrass process, in that it avoids the use of a certain axiom. This it does because the Bolzano-Weierstrass process essentially depends upon the successive division (the successive halving, for example) of the interval of the number-continuum containing the number-aggregate considered, and there is no known way of defining "division" among non-numerical numbers of any ordered aggregate. This statement requires some explanation. We can, of course, define the phrase " a divided by b " to mean anything we like. Thus, if " a " denotes Socrates, " b " Plato, and "divided by" means, say, add together the years (B. C.) of the births of a and b , and divide by some definite number, then " a divided by b " may denote a number which gives the year of birth of, say, Xenophon. But what we want here is a definition which has a meaning when a and b are members of any simply ordered aggregate (as Socrates, Plato, and Xenophon are, if, for example, they are arranged in the order of their times of birth), which meaning reduces to the ordinary arithmetical one when a and b are finite numbers. Now if we are given two transfinite simply ordered aggregates, and a and b are their respective ordinal types (ordinal type is a more general concept than ordinal number³), we can, as Cantor has shown, define $a + b$ and $a \cdot b$ in such a way that, when for a and b we put finite ordinal numbers, $a + b$ and $a \cdot b$ denote the numbers that these notations denote in ordinary arithmetic. And it would be possible to define $a - b$ and a/b ; but when M and N are transfinite, these notations would not denote one and only one number, as they do when a and b are finite, but a whole class of them. Thus $a - a$ may denote 0 or a itself . . . , and so on. But this would be no use to us in our case. In the

² *Quart. Journ. of Math.*, 1910, p. 218.

³ Cf. *Monist*, Jan. 1910, Vol. XX, pp. 96-98.

Bolzano-Weierstrass process, we are given a simply ordered aggregate of real numbers, and begin by halving it. This process of halving determines one and only one point, and it does this, *not because the aggregate is simply ordered, but because the aggregate is composed of finite, real numbers*. It is because division has been defined as a unique process for the *elements* of the aggregate. Consider the aggregate of real numbers from 0 to 1, including the ends, whose type Cantor has denoted⁴ by θ . When halving this interval we do not look for "the" element which terminates an interval extending from 0 and of type $\theta/2$. If there is such an element, there is an infinity of them. What we do is to determine *the one* element of the interval whose coordinate is $\frac{1}{2}$; that is to say, the number got by halving the difference (1-0) of the numbers which are the ends of the interval.

In other words, *it is because the aggregate of real numbers carries with it a scale of measurement*, while a simply ordered aggregate in general does not. Of course, we can give a simply ordered aggregate a scale of measurement which, *suo ipso*, it does not possess, by correlating it with the aggregate of real numbers or with part of that aggregate. Thus, as Mach has pointed out in his *Prinzipien der Wärmelehre*, a thermometer-scale primarily only indicates the hotter and the colder of two given states and does not give us any right to speak of a state A as being, say, "twice as hot" as state B, until we have (as we have now, since Thomson's introduction of the absolute scale) a means of correlating the degrees of expansion of a fluid with the real numbers. Not yet have we an absolute scale of hardness of minerals, so that hardnesses form a simply ordered continuum without any scale of measurement. We may remark, quite by the way, that though there seems to be an analogy between a simply ordered aggregate and the series of integers as defined by Richard Dedekind,⁵ and though Schröder in the third volume of his *Vorlesungen über die Algebra der Logik*,⁶ which is devoted to the logic of relatives, has pointed out this analogy as a special merit of Dedekind's theory, this analogy on closer inspection seems not to subsist.

The reason why this distinction between the absolute numerical scale and those simply ordered aggregates in which the elements only have relative positions is so important, will appear presently

⁴ *Math. Ann.*, Vol. XLVI, 1895, p. 510.

⁵ Cf. his *Essays on the Theory of Numbers*, Chicago, 1901.

⁶ Leipsic, 1895.

when we come to consider our treatment of space and time in mathematical physics.

But before we go any further we must explain a little the nature of the axiom mentioned above. Suppose that at any stage of a process we have to select an element—it does not matter which one—from a class of two or more. This is the case when we extend the Bolzano-Weierstrass process to simply ordered aggregates in general. If we have to do with real numbers, we may choose the definite point $\frac{1}{2}$ between 0 and 1, the definite point $\frac{3}{4}$ between $\frac{1}{2}$ and 1, the definite point $\frac{5}{8}$ between $\frac{1}{2}$ and $\frac{3}{4}$, and so on; but with a simply ordered transfinite aggregate in general we do not know of any means of finding a *specialized* (*ausgezeichnetes*) element between the ends of the aggregate, and we thus have an arbitrary choice among an infinity of elements between the ends of the aggregate considered. Now a form of the axiom in question is that when there is an infinity of classes of which each contains two or more members, it is possible to carry out for logical purposes—not, of course, *carry out* in the sense that we “*carry out*” the counting of a flock of sheep—the series of acts of arbitrary selection when this series is *infinite*. When the series is *finite* the axiom becomes a provable proposition; but when the series is *infinite* the method of proof by enumeration fails us.

This axiom, or rather an equivalent form of it, seems to have been first explicitly published by E. Zermelo in 1904,⁷ and it has lately been fully discussed in the part entitled “Selections” of the first volume of Whitehead and Russell’s *Principia Mathematica*.⁸ The chief importance of the axiom lies in its connection with the question as to whether any given aggregate can be well-ordered or not⁹—a question which is outside the range of the subject with which we are at present concerned.

The history of this axiom is sometimes very amusing. Cantor had no doubt about its truth, and avoided using it where he could; Borel felt grave doubts about its validity, and used a form of it without scruple; most mathematicians did not see that it was unproved until Zermelo pointed this out in 1904, and Schoenflies, in the second part (1908) of his *Bericht* on the theory of aggregates, still failed to recognize this axiomatic character. This sort of

⁷ Cf. pp. 360-366 of my paper “On the Comparison of Aggregates” in the *Quart. Journ. of Math.* for 1907.

⁸ Cambridge, 1910.

⁹ Cf. *Monist*, Jan., 1910, Vol. XX, p. 116.

thing is partly due to the neglect by mathematicians of logic and ideography.

Of course, we can only practically measure *relative* positions and motions; but when for scientific purposes we construct a mathematical model of the world, we assume that points of time and space can be represented by real numbers or complexes of real numbers (Cartesian coordinates) or vectors (numbers with two or more units). Now these numbers have, so to speak, an *absolute* position in their scale: each number has its own individuality. Thus, in the sense in which mathematicians speak of an "arithmetical space," in analytical mechanics we necessarily have to do with an absolute "space."

In analytical mechanics our time and space are necessarily aggregates of *numbers* because our description of dynamical events is effected by differential equations, and we cannot define a differential quotient, nor indeed division, for aggregates other than those of numbers. We can define many things usually considered to apply only to aggregates of numbers: thus *limit*, *continuity* of the independent variable, many of the characteristics—technically known as "closedness," "density in itself," "perfectness" and "compactness"—of aggregates of numbers, the notion of *function* and even of *continuous function* can be defined purely ordinally. But beyond this—into the differential and integral calculus—the purely ordinal theory of functions cannot go. If it could, then it would seem that we should have a means of describing mechanical events in a *relative* space; for a term in a series which can be fully described (for our purpose) by the giving of its ordinal type has, in general (unless, for example, it is the first or the last term), no property distinguishing it from another. To this circumstance is due the fact we observe when we try to transfer certain theorems of ordinary mathematical analysis to the ordinal theory of functions, namely, that whereas in ordinary analysis—owing to the fact that we have a scale of one measurement with the aggregate of numbers and so can determine uniquely a term (say "half-way") between two given ones—certain processes of proof like that of Bolzano and Weierstrass are determined uniquely at every one of an infinity of steps, we require, for the analogous process in the purely ordinal theory, an axiom (known by the name of Zermelo) permitting an infinite series of acts of arbitrary selection.

CAMBRIDGE, ENGLAND.

PHILIP E. B. JOURDAIN.

MAGIC STARS.¹

A five-pointed star being the smallest that can be made, the rules will be first applied to this one.

Choosing for its constant, or summation (S)=48, then:

$$(5 \times 48)/2 = 120 = \text{sum of series.}$$

Divide 120 into two parts, say 80 and 40, although many other divisions will work out equally well. Next find a series of five numbers, the sum of which is one of the above two numbers. Selecting 40, the series $6+7+8+9+10=40$ can be used. These numbers must now be written in the central pentagon of the star following the direction of the dotted lines, as shown in Fig. 1.

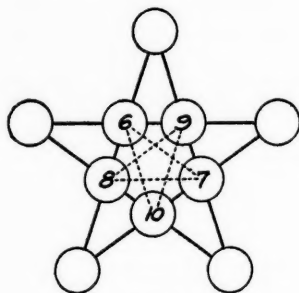


Fig. 1.

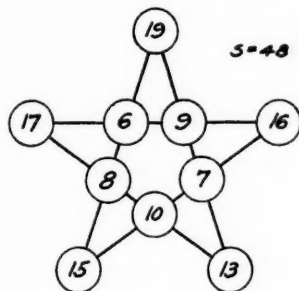


Fig. 2.

Find the sum of every pair of these numbers around the circle beginning in this case with $6+9=15$ and copy the sums in a separate column (A) as shown below:

	(A)
$6+9=15$	$17+15+16=48$
$7+10=17$	$16+17+15=48$
$8+6=14$	$15+14+19=48$
$9+7=16$	$19+16+13=48$
$10+8=18$	$13+18+17=48$

Place on each side of 15, numbers not previously used in the central pentagon, which will make the total of the three numbers = 48 or S. 17 and 16 are here selected. Copy the last number of

¹ We are indebted to Mr. Frederick A. Morton, Newark, N. J., for these plain and simple rules for constructing magic stars of all orders, and to Mr. H. A. Sayles, Schenectady, N. Y., for drawing the diagrams.

the trio (16) under the first number (17) as shown above, and under 16 write the number required to make the sum of the second trio = 48 (in this case 15). Write 15 under 16, and proceed as before to the end. If proper numbers are selected to make the sum of the first trio = 48, it will be found that the first number of the first trio will be the same as the last number of the last trio (in this case 17) and this result will indicate that the star will sum correctly if the numbers in the first column are written in their proper order at the points of the star, as shown in Fig. 2. If the first and last numbers prove different, a simple operation may be used to correct the error. When the last number is *more* than the first number, add half the difference between the two numbers to the first number and proceed as before, but if the last number is *less* than the first number, then *subtract* half the difference from the first number. One or other of these operations will always correct the error.

For example, if 14 and 19 had been chosen instead of 17 and 16, the numbers would then run as follows:

$$14 + 15 + 19 = 48$$

$$19 + 17 + 12 = 48$$

$$12 + 14 + 22 = 48$$

$$22 + 16 + 10 = 48$$

$$10 + 18 + 20 = 48$$

The difference between the first and last numbers is seen to be 6, and 20 being *more* than 14, half of 6 *added* to 14 makes 17 which is the correct starting number. Again, if 21 and 12 had been selected, then:

$$21 + 15 + 12 = 48$$

$$12 + 17 + 19 = 48$$

$$19 + 14 + 15 = 48$$

$$15 + 16 + 17 = 48$$

$$17 + 18 + 13 = 48$$

The difference between the first and last numbers is here 8, and the last number being *less* than the first, half of this difference subtracted from 21 leaves 17 as before.

It is obvious that the constant S of a star of any order may be changed almost indefinitely by adding or subtracting a number selected so as to avoid the introduction of duplicates. Thus, the constant of the star shown in Fig. 2 may be reduced from 48 to

40 by subtracting 4 from each of the five inside numbers, or it may be increased to 56 by adding 4 to each of the five outside numbers, and another variant may then be made by using the five inside numbers of $S=40$, and the five outside numbers of $S=56$. These three variants are shown respectively in Figs. 3, 4 and 5.

It is also obvious that any pair of five-pointed or other stars may be superposed to form a new star, and by rotating one star over the other, four other variants may be made; but in these and

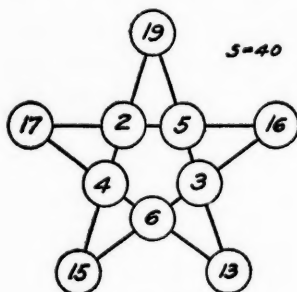


Fig. 3.

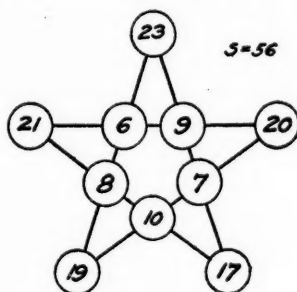


Fig. 4.

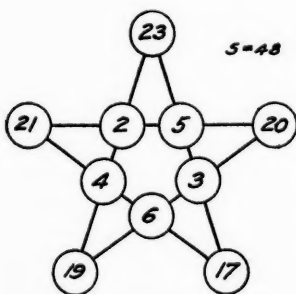


Fig. 5.

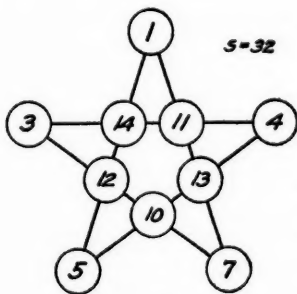


Fig. 6.

similar operations duplicate numbers will frequently occur, which of course will make the variant ineligible although its constant must necessarily remain correct.

Variants may also be made in this and all other orders of magic stars, by changing each number therein to its complement with some other number that is larger than the highest number used in the original star. The highest number in Fig. 2, for example, is 19. Choosing 20 as a number on which to base the desired variant,

19 in Fig. 2 is changed to 1, 17 to 3 and so on throughout, thus making the new-five-pointed star shown in Fig. 6 with $S=32$.

The above notes on the construction of variants are given in detail as they apply to *all orders* of magic stars and will not need repetition.

The construction of a six-pointed star may now be considered. Selecting 27 as a constant:

$$(6 \times 27)/2 = 81 = \text{sum of the series.}$$

Divide 81 into two parts, say 60 and 21, and let the sum of the six numbers in the inner hexagon = 21, leaving 60 to be divided among the outer points. Select a series of six numbers, the sum

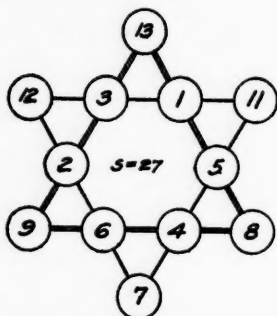


Fig. 7.

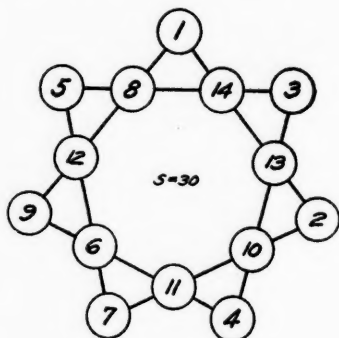


Fig. 8.

of which is 21, say 1, 2, 3, 4, 5, 6, and arrange these six numbers in hexagonal form, so that the sum of each pair of opposite numbers = 7. Fig. 7 shows that these six inside numbers form part of two triangles, made respectively with single and double lines. The outside numbers of each of these two triangles must be computed separately according to the method used in connection with the five-pointed star. Beginning with the two upper numbers in the single-lined triangle and adding the couplets together we have:

$$\begin{aligned} 3+1 &= 4 \\ 5+4 &= 9 \\ 6+2 &= 8 \end{aligned}$$

$$\begin{aligned} (A) \quad 12+4+11 &= 27 \\ 11+9+7 &= 27 \\ 7+8+12 &= 27 \end{aligned}$$

Writing these sums in a separate column (A) and proceeding as

before described, the numbers 12, 11, 7 are obtained for the points of the single-lined triangle, and in the same manner 13, 8, 9 are found for the points of the double-lined triangle, thus completing the six-pointed star Fig. 7.

The next larger star has seven points. Selecting 30 for a constant, which is the lowest possible:

$$(7 \times 30) / 2 = 105 = \text{sum of the series.}$$

Dividing this sum as before into two parts, say 31 and 74, seven numbers are found to sum 74, say, $6+8+10+11+12+13+14=74$, and these numbers are written around the inside heptagon

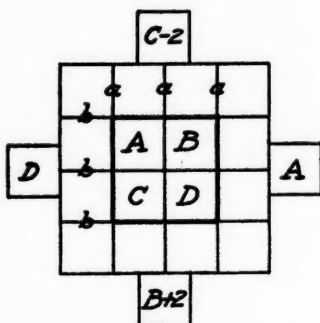


Fig. 9.

	1	2	3	4
5	6	7	8	9
5	11	12	13	14
5	16	17	18	19

Fig. 10.

as shown in Fig. 8. Adding them together in pairs, their sums are written in a column and treated as shown below, thus determining the numbers for the points of Fig. 8.

$$14 + 13 = 27$$

$$10 + 11 = 21$$

$$6 + 12 = 18$$

$$8 + 14 = 22$$

$$13 + 10 = 23$$

$$11 + 6 = 17$$

$$12 + 8 = 20$$

$$1 + 27 + 2 = 30$$

$$2 + 21 + 7 = 30$$

$$7 + 18 + 5 = 30$$

$$5 + 22 + 3 = 30$$

$$3 + 23 + 4 = 30$$

$$4 + 17 + 9 = 30$$

$$9 + 20 + 1 = 30$$

The next larger star has eight points and it can be made in two different ways, viz., By arranging the numbers in one continuous line throughout as in stars already described having an odd number of points, or by making it of two interlocking squares.

The latter form of this star may be constructed by first making a 4^2 with one extra cell on each of its four sides, as shown in Fig. 9. A series of sixteen numbers is then selected which will meet the conditions shown by italics *a, a, a*, and *b, b, b*, in the figure, i. e., all differences between row numbers must be the same, and also all

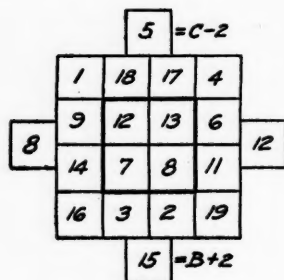


Fig. 11.

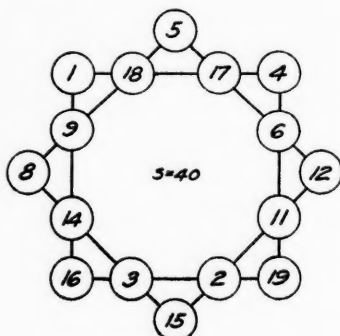


Fig. 12.

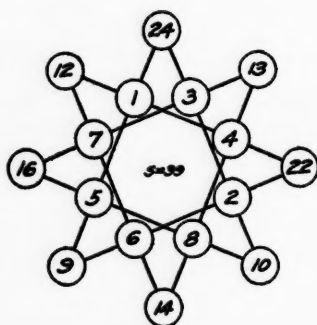


Fig. 13.

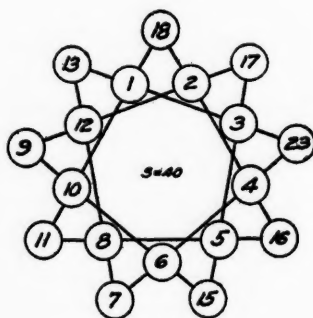


Fig. 14.

differences between column numbers, but the two differences must be unlike. The constant (*S*) of the series when the latter is arranged as a magic 4^2 must also be some multiple of 4. The series is then put into magic formation by the old and well-known rule for making magic squares of the 4th order. The central 2×2

square is now eliminated and the numbers therein transferred to the four extra outside cells as indicated by the letters A. B. C. D. Finally all numbers are transferred in their order into an eight-pointed star.

A series of numbers meeting the required conditions is shown in Fig 10, and its arrangement according to the above rules is given

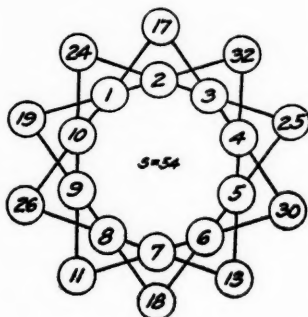


Fig. 15.

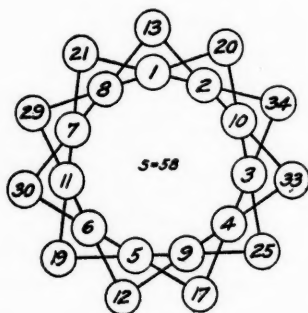


Fig. 16.

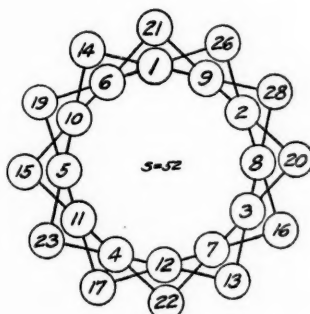


Fig. 17.

in Fig. 11, the numbers in which, transferred to an eight-pointed star, being shown in Fig. 12, $S=40$. The 4^2 magic arrangement of the series must be made in accordance with Fig. 11, for other magic arrangements will often fail to work out, and will never do so in accordance with Fig. 9. The above instructions cover the simplest method of making this form of star but it can be constructed in

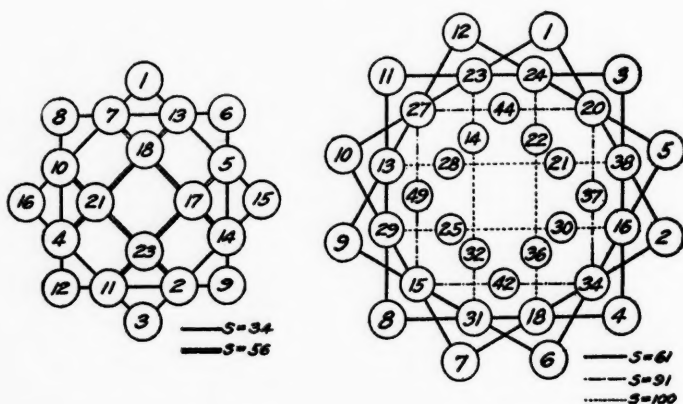
many other different ways and also with constants which are not evenly divisible by 4.

Turning now to the construction of the eight-pointed star by the continuous line method, inspection of Figs. 12 and 13 will show that although the number of points is the same in each star yet the arrangement of numbers in their relation to one another in the eight quartets is entirely different.

Choosing a constant of 39 for an example:

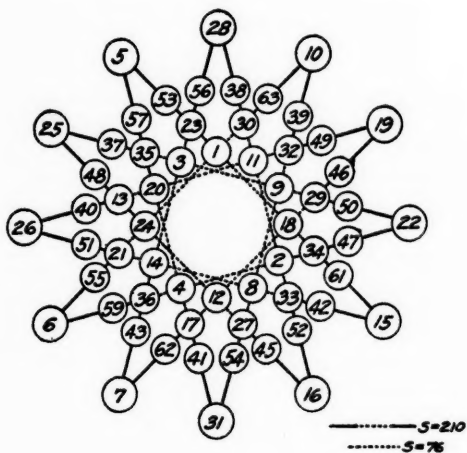
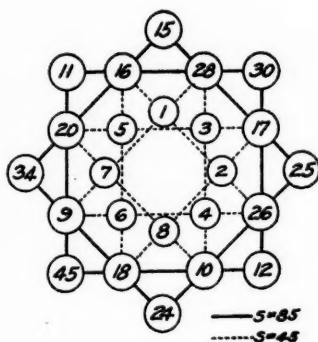
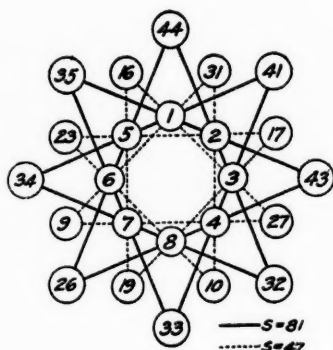
$$(39 \times 9) / 2 = 156 = \text{sum of series.}$$

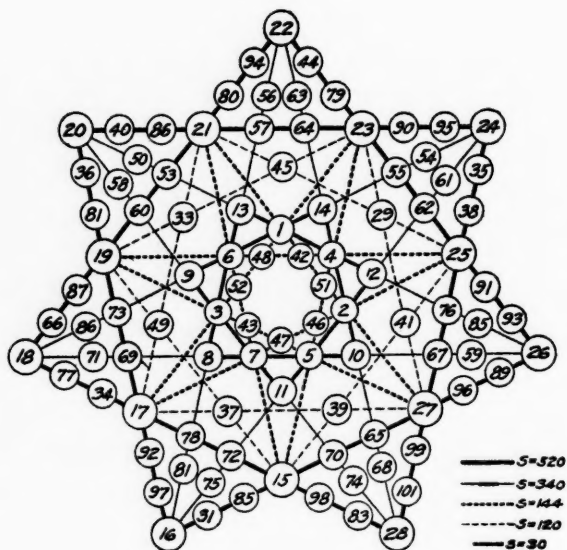
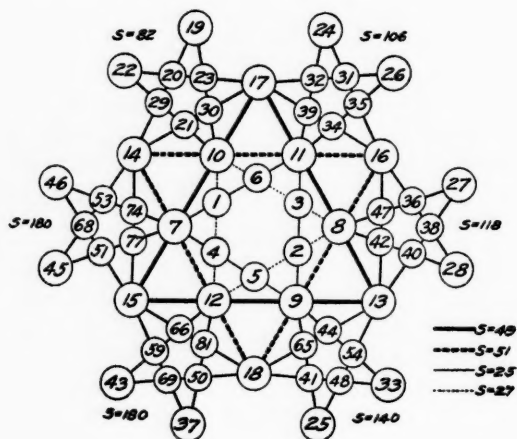
This sum is now divided into two parts, say 36 and 120. The sum of the first eight digits being 36, they may be placed around the

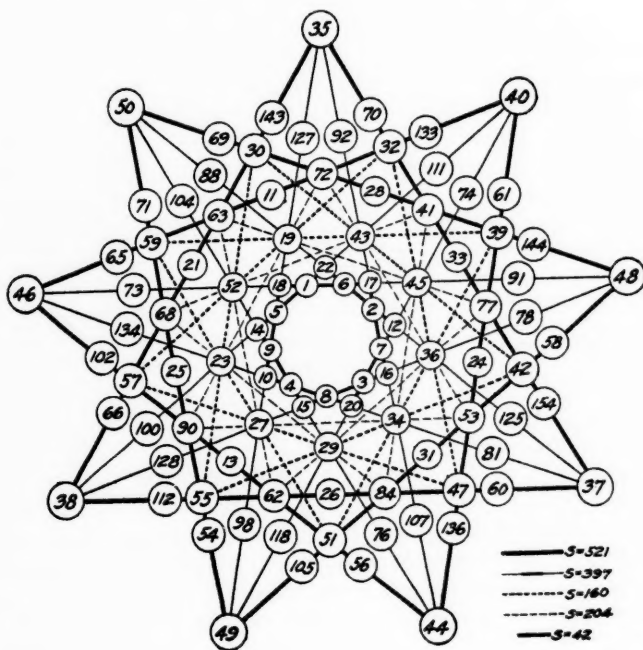
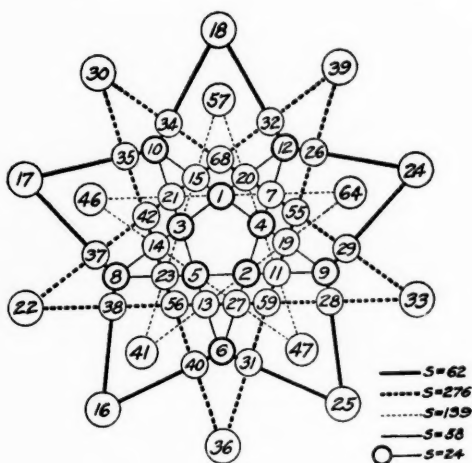


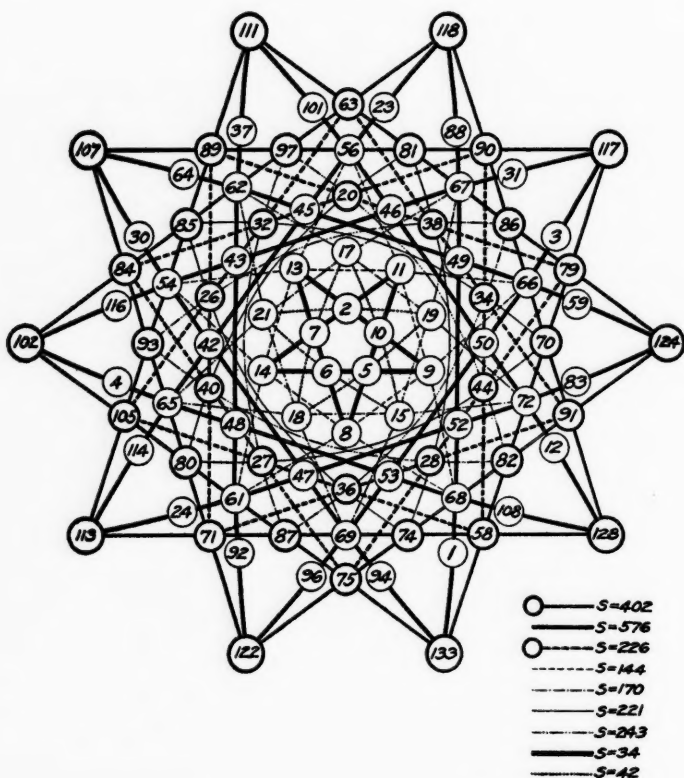
inside octagon so that the sum of each opposite pair of numbers = 9, as shown in Fig. 13. Adding them together in pairs, as indicated by the connecting lines in the figure, their sums are written in a column and treated as before explained, thus giving the correct numbers to be arranged around the points of the star Fig. 13.

These rules for making magic stars of all orders are so simple that further examples are deemed unnecessary. Nine-, ten-, eleven-, and twelve-pointed stars, made by the methods described, are shown respectively in Figs. 14, 15, 16, and 17. Several other diagrams of ingenious and more intricate star patterns made by Mr. Morton are also appended for the interest of the reader.









W. S. ANDREWS.

SCHENECTADY, N. Y.

RECENT PERIODICALS.

In *Scientia* (*Rivista di Scienza*) for May, 1914, the first article is by A. Einstein on the principle of relativity. It is only fair, after the criticisms of Marcel Brillouin and Max Abraham, that an article written by one of the chief advocates of the theory should appear in *Scientia*. Einstein distinguishes two theories of relativity: the theory in the "narrow sense" and that in the "wide sense." If we refer a motion to a system of coordinates K, for which the Newtonian equations are valid, any other system of

coordinates which is in a uniform motion of translation with respect to K can be substituted for K. The "principle of relativity in the narrow sense" is the hypothesis of the equivalence of all such systems of coordinates for the formulation of the laws of motion and of the general physical laws. Thus, the principle of relativity is as old as mechanics itself, and, from the point of view of experience, its validity could never be doubted. However, the electrodynamics of Maxwell and Lorentz leads to the conclusion that every luminous ray is propagated in the vacuum with a determined velocity c which is independent of the direction of propagation and the state of motion of the luminous source. This deduction seems to be inconsistent with the principle of relativity. But an exact analysis of the content of our spatial and temporal data has proved that this inconsistency is only apparent, since it rests on the following arbitrary hypotheses: (1) The assertion that two events taking place in different places are simultaneous, has a content independent of the choice of the system of reference; (2) The distance between the places where two events simultaneously take place is independent of the choice of the system of reference. If we give up these arbitrary hypotheses, the above principle of the constancy of the velocity of light, which results from the well-attested theory of Maxwell and Lorentz, becomes compatible with the principle of relativity. The theories of gravitation are not all, as Abraham stated, inconsistent with the principle of relativity. The second part of the article is devoted to the "theory of relativity in the wide sense," which has hitherto hardly been confirmed by experience, but to which Einstein has been led from his philosophical standpoint, and which may be regarded as a development, and not an abandonment of the former theory of relativity. Svante Arrhenius discusses the problem of the formation of the milky way. Filippo Bottazzi gives the first article of a study on the fundamental physiological activities, entitled "nervous activity and the elementary processes on which it is founded." J. Arthur Thomson discusses "Sex-characters" and gives a critical review of Kammerer's great work on the collection of experimental data on the origin, evolution and development of sex-characters. A. Meillet has a paper on the problem of the parentage of languages. The difficulty experienced in making all languages enter into the genealogical classification has led certain eminent linguists to take away from the principle of this classification its precision and rigor or to

apply it in an inexact manner. This article shows in how far a genealogical classification of languages is possible and useful, and what can be hoped from it. Roberto Michels writes on economy and politics. Aldo Mieli has a critical note on the precursors of Galileo, in which he gives an account of the researches of Pierre Duhem on the origins of Galilean dynamics in the Middle Ages. Jean Buridan, who was rector of the university of Paris from 1327 to 1347, had a very clear idea of what has been called, since Leibniz, *vis viva*. What he called "impetus" he determined by the multiplication of velocity, volume, and density, and explained the cause of the accelerated motion of falling bodies. Buridan also applied to the heavens the dynamics established for earthly motions. "Newton," says Duhem, "had an idea of mass which was not very different from that which Buridan defined." Other people dealt with in this note are Nicole Oresme, who died in 1382, and had anticipated Copernican astronomy and Cartesian geometry, and discovered the Galilean law according to which the space described by a uniformly accelerated body increases with the times; Albert de Saxe, who anticipated a well-known error of Galileo's; and Dominique Soto, who was born in 1494. It is interesting to notice that this work of Duhem's is referred to very fully in the additions to the last German edition of Mach's *Mechanics*. A supplementary volume containing these additions will shortly be issued by the Open Court Publishing Co., so as to make it possible to read these additions in a small volume separate from the English fourth edition, without the expense of buying a large new book. There is also, in *Scientia*, a general review by L. Sualì on the history of Indian philosophy. There are various reviews of books and periodicals, a chronicle of recent and forthcoming events and French translations of English, German, and Italian articles.

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In *Mind* for April, 1914, the first article is by C. Lloyd Morgan on "Are Meanings Inherited?", in which the author discusses recent publications by Stout and McDougall. Henry Rutgers Marshall has a short paper on "Psychic Function and Psychic Structure." F. Melian Stawell puts a number of questions about Bertrand Russell's *Problems of Philosophy* (London and New York, 1912). Horace M. Kallen writes on "James, Bergson, and Traditional Metaphysics." C. I. Lewis had, in a paper of 1912, tried to show that "the present calculus of propositions, in the algebra of logic,

is to ordinary inference what a non-Euclidean geometry is to our space. In particular, it asserts the presence of implication relations whose existence in our world may be doubted." The purpose of this note is "to outline a 'Euclidean' calculus of propositions—that is, one which will be applicable throughout to our ordinary modes of inference and proof." Charles Mercier, continuing the discussion between various logicians as to whether inversion is a valid inference, decides that it is not, and has some amazing sneers at traditional logic. "For practical purposes," says he, "the syllogism is about as useful as an unreliable apparatus for converting new-laid eggs into stale ones." A sympathetic review, by Miss E. E. C. Jones, of Mercier's *New Logic* (London, Heinemann, 1912; Chicago, The Open Court Publishing Co.), is contained in this number of *Mind*. J. E. Turner makes some critical remarks on Bertrand Russell's treatment of sense-data and knowledge in his *Problems*. Many reviews of books and periodicals and other notes etc., follow.

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In the *Revue de Métaphysique et de Morale* for May, 1914, there is a very thorough study, by D. Rouston of the moral philosophy of Frédéric Rauh. There is a reproduction of Maurice Caelery's lecture before the Paris School of Advanced Social Studies on the nature of biological laws, in which the author concludes, like O. Bütschli, that we can only grasp that part of vital phenomena which can be explained physico-chemically, and we can say of both vitalism and mechanism: "By their fruits ye shall know them." Emile Bréhier writes on philosophy and myth. Edmond Laskine contributes the second and final part of his critical study of the transformations of law in the nineteenth century. Charles Dunan discusses the practical question of electoral rights. There is the usual supplement containing reviews of new books and periodicals, and other notes.

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BOOK REVIEWS.

ENCYCLOPAEDIA OF THE PHILOSOPHICAL SCIENCES. Vol. I, Logic. By *Arnold Ruge, Wilhelm Windelband* and others. Translated by *B. Ethel Meyer*. London: Macmillan, 1913. Pp. 269. Price \$2.00.

This is an English edition of the German encyclopedia of Windelband and Ruge, made under the direction of Sir Henry Jones. The present volume comprises articles from eminent thinkers of Europe and America which are intended to present the determining principle of their thought upon the subject of logic. The views of German logicians are represented by Windelband of Heidelberg, who treats very generally of the phenomenology of knowledge, methodology and the theory of knowledge. The logic of English speaking countries is represented not by Russell or Peirce but by Professor Royce of Harvard who deals particularly with the types of order and with the relation of logic as methodology to logic as the science of order. M. Couturat expresses embarrassment in representing French philosophy, first because he makes no claim to expressing the views of French philosophers on logic, and second because the theories he presents are due to authors of Italy, Germany and England and particularly not of France—though in thus disclaiming for France any part in the logistic movement he is unfair to the significance of his own work in this line. For this new type of logic he prefers the term "logistic" or "algorithmic logic" to the formerly prevalent "symbolic" or "mathematical" logic or the "algebra of logic." From the point of view of this modern logistic he explains the principles and methodology of the logic of propositions, of concepts and of relations, and the relation between logic and language.

Benedetto Croce of Naples, in treating of "The Task of Logic," disregards the claims of the logicians on the ground that logistic while providing rules for practice cannot be a science, and he considers logic as essentially a science, but a philosophical as distinct from an empirical science. He says: "It is no part of its business to assist thought,—to further the progress of natural science, mathematics or any of the special sciences, to facilitate research or to simplify the art of disputation. It is a theory entirely devoted to the task of inquiring into the nature of thought, as exemplified in science as a whole and in the particular sciences."

Another Italian, Professor Enriques of Bologna, treats the problems of logic in a more representative and eclectic manner as the science of exact thinking. He summarizes logical principles, operations, concepts and relations, discussing also definition and deduction. He then analyzes briefly the validity of logical principles and the relation of logic to metaphysical thought.

In this volume Russia is represented by Nicolaj Losskij who writes on "The Transformation of the Concept of Consciousness in Modern Epistemology and its Bearing on Logic."